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# **NAVAL POSTGRADUATE SCHOOL**

**MONTEREY, CALIFORNIA**

## **THESIS**

**THE RETENTION OF FEMALE UNRESTRICTED LINE  
OFFICERS**

by

Elena G. Pecenco

March 2005

Thesis Co-advisors:

Stephen L. Mehay  
William R. Bowman

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**THE RETENTION OF FEMALE UNRESTRICTED LINE OFFICERS**

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Lieutenant, United States Navy  
B.S., University of Pennsylvania, 1996

Submitted in partial fulfillment of the  
requirements for the degree of

**MASTER OF BUSINESS ADMINISTRATION**

from the

**NAVAL POSTGRADUATE SCHOOL  
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## **ABSTRACT**

This thesis analyzes the retention of female Naval officers, focusing on the relationship between officer selection metrics and retention beyond minimum service obligation and the effect of lateral transfers on the retention of junior officer in the Unrestricted Line. The retention analysis utilizes data from Naval Academy cohorts 1988-1991, while the lateral transfer analysis uses data from officer cohorts 1986-1991 available through the Officer Promotion History File. The retention analysis focuses on whether the elements of the Naval Academy's Whole Person Multiple (WPM) are valid predictors of graduation and fleet retention beyond minimum service requirement for female officers. Results indicate that the WPM is generally a poor predictor of female graduation and retention, a result that is contrary to previous research that used mixed gender or male-only samples. Only the Math SAT, English/Math teacher recommendation score, and athletic/non-athletic extracurricular activities score have positive and significant relationships with retention beyond minimum service requirement. Thus, it is recommended that the Naval Academy Admissions Board develop a revised selection metric for females in order to select and commission female officers with a greater propensity for career service. The lateral transfer analysis seeks to determine the characteristics of officers in the Navy's lateral transfer system. Results reveal that women are more likely than men to transfer from Unrestricted Line to Restricted Line communities. This higher likelihood of lateral transfer for women is considered a major contributor to the low retention of female officers in Unrestricted Line communities.



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## **I. INTRODUCTION**

### **A. BACKGROUND**

Current attrition of female officers has produced alarming officer management deficits and major trends of female exodus at the conclusion of required service, particularly in the Surface Warfare community. Without a significant reversal of these trends, anticipated deficits in Surface Warfare and other warfare areas currently manned through female accessions will experience major strength deficits in out years. A Bureau of Naval Personnel presentation of Surface Warfare Officer (SWO) retention indicates that females accept the Surface Warfare Officer Continuation Pay (SWOCP) at half the rate of males, demonstrating the greater propensity of women to leave the Navy upon completion of their initial Division Officer tours (Aycok, 2004).

Despite their significantly reduced propensity to remain in the Navy beyond their minimum service requirement, females comprise a growing percentage of junior officers at the O-1 and O-2 levels. The proportion of female officer accessions (excluding medical) grew from 9.8 percent to 13.9 percent from 1994-1999. In the Surface Warfare community, the growth has been even more dramatic. Females comprised 11 percent of SWO accessions in 1994, a figure which grew to 24 percent by 1999 (Koopman, Thomas, Parcell, and MacIlvaine, 2000). By 2004, women comprised 26.2 percent of O-1 SWOs (OWP, 2004). The 2004 statistics reveal that this growth in female Surface Warfare Officers only continues through the O-2 level. Due to high separation rates, females comprised 14.9 percent of SWOs at the O-3 level and only 2.0 percent of O-4s.

The inability to retain female officers beyond their minimum service requirement is not unique to the Surface Warfare community. While females account for over 17 percent of all Navy officers at the Ensign and Lieutenant (junior grade) levels, they comprise only 11.4 percent of Captains and 4.9 percent of Admirals (OWP, 2004). It is also important to note that many female officers at the senior levels are in the Restricted Line (RL) and Staff Corps, further lowering the percentage of senior females in the Unrestricted Line (URL). In 1999, 90 percent of female SWOs were in the O-1 to O-3

grades while 70 percent of women in the Fleet Support community were O-4s to O-6s (Koopman, Thomas, Parcell, and MacIlvaine, 2000).

Aside from the issue of maintaining gender diversity throughout all levels of the officer corps, the Navy is becoming increasingly concerned with the exodus of female junior officers due to the hard and soft costs of manning overages and underages. The Surface Warfare community, in particular, is experiencing manning overages at the O-1 to O-3 levels but manning underages at the O-4 level (Thie et al., 2003). It is not difficult to speculate that these manning difficulties are exacerbated by the growing number of female accessions who leave the Navy prior to the O-4 promotion board.

Lateral transfers from URL communities into RL and staff communities are further aggravating manning overages and underages and the disparity between male and female URL retention. Koopman, Thomas, Parcell, and MacIlvaine (2000) found that, by the 36 month point in service, more women than men lateral transfer out of the Surface Warfare and Aviation communities. From a larger perspective, the Navy continues to struggle with the extent to which the Surface Warfare community should bear the burden of manning and training junior officers who plan to lateral transfer into Restricted Line and staff communities upon receipt of warfare qualification (Moore and Reese, 1997).

Due to the rising costs of continually accessing female officers who are not retained beyond their minimum service obligation, the Chief of Naval Personnel's (CNP) Strategic Planning and Analysis cell proposed research concerning the role of current criteria used to select applicants into officer commissioning programs in explaining female officer separation decisions. The goal of this research is to determine whether the Navy could alter its accession metrics for officer programs in order to select women with a propensity for prolonged naval service. A propensity for prolonged naval service is defined as service beyond the minimum service requirement, which is often continued into career service. This research is co-sponsored by the CNP's Strategic Planning and Analysis cell and Office of Women's Policy.

## **B. PURPOSE**

The purpose of this study is to determine whether the accession metrics used by the Naval Academy Admissions Board are valid and effective in selecting women with a propensity for extended naval service. The data is drawn solely from Naval Academy admissions but the results of the thesis should also be applicable to Naval Reserve Officer Training Corps (NROTC) four-year scholarship recipients. Although the exact metrics used by the Naval Education and Training Command (NETC) scholarship board in selecting NROTC four-year scholarship recipients have not been disclosed (J. S. Snyder, personal communication, January 22, 2005), the application processes for the Naval Academy and NROTC are comparable. NROTC does not require a nomination; however, both commissioning sources consider similar elements of high school performance in their selection processes. Similar to the Naval Academy, NETC indicates that it is “looking for well-rounded applicants who have demonstrated academic skills, leadership potential, overall physical fitness and healthy lifestyle choices, and a belief in and commitment to service” (NETC, 2004) and includes the following categories on the four-year scholarship application: test scores (SAT or ACT); educational history and goals; employment and volunteer history; school and other activities; and personal essays. These categories contain similar information to that used in the Naval Academy admissions process. Research applicability to NROTC is important because approximately 30 percent of NROTC scholarships are held by women (Koopman, Thomas, Parcell, and MacIlvaine, 2000).

Although applicable to NROTC, the results of this thesis may not be as relevant for officers commissioned through Officer Candidate School (OCS), who are generally selected after completing college. Selection for OCS is based upon undergraduate academic performance and extracurricular activities and/or community service while in college. High school performance and activities are thus not as important to the OCS selection process.

## **C. RESEARCH QUESTIONS**

This study will determine whether the primary elements of the Whole Person Multiple used in the Naval Academy selection process, including SAT scores, high



school rank, participation in high school athletic and non-athletic activities, teacher recommendations, scores from the Strong Interest Inventory, and Recommendation of the Admissions Board (RAB) points, are predictors of retention beyond minimum service requirement. The following research questions are examined by this thesis:

- 1.) Are the accession metrics used by the Naval Academy effective in selecting females with a propensity for extended naval service?
- 2.) Can the current accession metrics be re-weighted to select females who have a higher propensity for extended naval service?

This thesis also explores the issue of lateral transfers and how this relates to retention of females in the Unrestricted Line. The following research question is examined:

- 3.) Are females more likely than males to lateral transfer from Unrestricted Line to Restricted Line communities?

#### **D. METHODOLOGY**

Data representing females in the 1988-1991 cohorts of the Naval Academy will be used to analyze research questions one and two. Question three will use data representing men and women in the 1986-1991 officer cohorts. These data include officers commissioned through a variety of commissioning programs, not just the Naval Academy. All data were received from William R. Bowman at the Naval Academy. Naval Academy accession information was derived from data bases held by the Academy's Office of Institutional Research. Retention information was available through the Naval Officer Promotion History File and Loss File.

Following a discussion of descriptive statistics, regression models are built to predict the effect of various selection metrics on the decision to stay past minimum service requirement. The significance and strength of the selection metrics are used to determine whether current metrics are effective in selecting women with a propensity for extended naval service. Additional multivariate regression models are built to determine the characteristics of officers in the Navy's lateral transfer system.

## **E. ORGANIZATION OF STUDY**

Chapter II reviews prior studies of female officer retention, focusing on the propensity of women to leave the naval service after their minimum service requirement and reasons cited by women for leaving. Chapter II also outlines the Naval Academy admissions process and reviews past research concerning the effectiveness of selection metrics, such as SAT scores and high school GPA, in predicting success both at USNA and in the naval service or chosen community upon graduation.

Chapter III presents the quantitative data obtained from various sources at the Naval Academy for females in cohorts 1988-1991. Patterns in the data will be discussed and further analyzed in the subsequent regression analysis. Chapter III also presents the rationale behind the multivariate regression model used to analyze the probability of retention.

Chapter IV analyzes the results of the retention regression model and discusses the effectiveness of using selection metrics as predictors of retention past minimum service requirement.

Chapter V analyzes the characteristics of Unrestricted Line Officers in the Navy's lateral transfer system. URL communities, particularly Surface Warfare, have expressed concern over the loss of female junior officers following initial tours. This loss may be due to female officers exiting the naval service completely upon minimum service requirement or transferring out of their initial URL community into a Restricted Line community. Chapter V analyzes whether females are more likely than males to transfer from URL to RL and also discusses the other characteristics of officers in the lateral transfer system.

Chapter VI concludes the study and evaluates the effectiveness of the current USNA accession process in selecting women with a propensity for extended naval service. This chapter also provides recommendations to the Naval Academy Admissions Board for improving the current admissions process.

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## **II. LITERATURE REVIEW**

### **A. INTRODUCTION**

This literature review is comprised of two main sections. The first section surveys both quantitative and qualitative studies of female officer retention. Statistics concerning female versus male retention are discussed, followed by reasons women cite for leaving the naval service upon completion of their minimum service requirement. The second section outlines the Naval Academy admissions process and presents research concerning the validity of accession metrics in predicting performance both at the Academy and, when available, in the fleet or chosen designator upon graduation.

### **B. RETENTION STUDIES**

#### **1. Quantitative Retention Studies**

The number of women in the military has been growing rapidly during the past two decades. From 1977 to 1997, female representation in the officer corps rose from 5.9 percent to 14.1 percent. During the military drawdown of 1987-1997, the representation of women actually increased from 11.0 percent to 14.1 percent (OSD, n.d.). As of September 2004, women account for 14.8 percent of all naval officers (OWP, 2004).

Following the repeal of combat exclusions in 1993 and 1994, the majority of military occupations are now open to women. Only four percent of occupations and nine percent of assignments in the Navy remain closed to women, with these occupations and assignments concentrated in Special Warfare and the Submarine service (WREI, 2000; OSD, n.d.). The integration of women into combat units during the 1990's, including combat air squadrons and combatant ships, proved less troublesome than anticipated. Harrell and Miller (1997) found that gender integration had a relatively small effect on unit readiness, cohesion, and morale. While individual units and servicemembers may have experienced temporary difficulties, the combat exclusion repeal and almost comprehensive integration of women into military combat units had a minimal effect on readiness.

Although women remain concentrated in traditionally female occupations such as personnel, administration, and healthcare, a major trend in the DoD is the increasing percentage of junior women officers entering the services' mainstream combat occupations (Hosek et al., 2001; WREI, 2000). For example, the number of women entering Navy Unrestricted Line communities, specifically Surface Warfare and Aviation, has risen rapidly since the early 1990's. In 2003, females comprised 24.5 percent of O-1 SWOs (Clifton, 2003), a figure which grew to 26.2 percent in 2004 (OWP, 2004). Unfortunately, the growing number of female officers, particularly in the Surface Warfare community, is concentrated in the junior levels.

A study of the Department of Defense (DoD) revealed that, in each service, women within a cohort are less likely to promote to O-4 than males, due primarily to women leaving the military at earlier career stages. On average, promotion rates for white women are approximately the same as those of white men. Indeed some studies have shown that female junior officers are out-performing their male peers. Female Navy officers are more likely than males to receive a recommendation for early promotion (RAP) on their fitness reports and women are more likely than men to attain their SWO qualification on similar ship types (Hosek et al., 2001).

Despite out-performing their male peers, female officers are still less likely to promote to O-4 due to their high rates of separation from the service. White women are 14 percent more likely to leave during retention periods prior to O-4 than white men (OSD, n.d.; Hosek et al., 2001). This DoD trend of junior officer exodus is especially prevalent in the Navy. Females account for 17 percent of all Navy officers at the O-1 level but only 14.4 percent at the O-4 level. The figures continue to decline at the higher ranks; women represent only 11.4 percent of Captains and 4.9 percent of Admirals.

The statistics are even more bleak in the Surface Warfare community. Females SWOs account for over 26.2 percent of Ensigns (O-1) but only 2.0 percent of Lieutenant Commanders (O-4). This significant loss in female representation is caused by the exodus of junior officers at the completion of their initial obligation. A BUPERS presentation of SWO retention reveals that female SWOs accept SWOCP at half the rate of their male peers. For example, in the 1997 and 1998 cohorts, males accepted SWOCP

at rates of 37.0 percent and 35.9 percent respectively, compared to female rates of only 16.7 percent and 17.3 percent (Aycock, 2004). Acceptance of SWOCP indicates that an officer has obligated to remain in the Surface Warfare community for Department Head tours. Clearly, females are half as likely as males to retain beyond the minimum service requirement in the Surface Warfare community.

## **2. Costs of Manning Overages and Shortages**

In addition to concerns about maintaining gender diversity throughout the officer corps, the Navy is becoming alarmed by the growing costs associated with manpower overages and shortages in the officer corps caused by the exodus of female junior officers. Thie et al. (2003) detail the hard and soft costs associated with manpower misalignment. Hard costs include the accession, training, and compensation costs for officer trainees and junior officers. Soft costs result when units are overmanned, undermanned, mis-ranked, and/or mis-skilled. Soft costs include lower performance due to training, motivation, or other deficiencies; readiness problems due to uncompleted work or low retention; and low workforce task cohesion due to crew instability.

Thie et al. (2003) call particular attention to the Surface Warfare community. Noting that in 2000, SWOs were overmanned at the O-1 to O-3 levels but undermanned at the O-4 level, the authors estimate that

the current personnel management system may be the root cause of such patterns. Frequently, because of long-standing shortages at grade O-4, the system compensates by accessing more officers than otherwise needed in the hope that, 10 years later, the O-1 will become an O-4. Given manning needs on ships, however, it may not be feasible to provide all the officers satisfactory experience (p.96).

The trend for female SWOs to leave the Navy upon completion of their initial tours may have caused and can only exacerbate the personnel misalignment of the Surface Warfare community. In addition to the hard costs associated with accessing and training female officers who will only serve for a minimum number of years, Thie et al. warn that “if the excess O-1 to O-3 officers are actually filling O-4 billets or ‘double filling’ O-1 to O-3 billets, then there are undoubtedly high soft costs being paid as well that will affect future behavior of individual officers” (p.108). Thus, the Navy’s inability to retain female junior officers can have a negative effect on unit readiness and on the

retention decisions of male officers who suffer the soft costs of continued manpower misalignment.

### **3. Qualitative Retention Studies**

Most quantitative studies and presentations of descriptive statistics concerning female officer retention are followed by qualitative research seeking to determine the reasons women are choosing to leave the military upon completion of their minimum service requirement. Hosek et al. (2001) conducted focus groups with female servicemembers to determine why women were dissatisfied with their time in the military. The three main reasons why women choose to separate from the military at substantially greater rates than men are being concentrated in certain occupational specialties that afforded less opportunities for promotion, a lack of consensus among servicemembers on the role for women in the military, and competing family obligations.

While the lift of combat exclusions in the 1990's opened most military occupations to women, one-half of female officers are in professional occupations, primarily health, compared to one-fifth of males. However, this trend is steadily changing, as evidenced by the increased number of women entering the Navy's URL communities.

Many women also felt that there continues to be no clear agreement among military personnel over the appropriate role of women in the military. Women believe they are perceived as less capable than their male counterparts. This finding was confirmed by the OSD study (n.d.), which reported that female servicemembers feel they are held to a higher standard than white males and that they must pass "tests" to demonstrate their worth on the job. Women also perceive that they have greater difficulty forming peer and mentor relationships and receive fewer career-enhancing assignments (Hosek et al., 2001).

Many female servicemembers found their diminished career opportunities to be intertwined with sexual harassment issues. Sexual harassment was brought up in each focus group conducted by Hosek et al. While most women reported that the harassment had occurred at earlier times in their careers, male officers' fears of being charged with sexual harassment soured male-female interactions, both socially and in the workplace.

Women thus find it difficult to find mentors and to receive career enhancing assignments, which often require one-on-one interaction with male officers.

Female servicemembers also cited family obligations as a major barrier to remaining in the military. Two primary concerns were child care arrangements and military spouse considerations. Far more women than men are single parents. Indeed, female officers are considerably less likely than men to be married at all career stages. At entry, one-half of men are married, compared to one-third of women. In the senior ranks (O-5 and O-6), 90 percent of male servicemembers are married, compared to only 55 percent of females. When females are married, they are more likely to be married to another servicemember which adds the complications of co-location. In addition, married women are making more compromises than their spouses. Married female officers are more than four times as likely as their male peers to be geographic “bachelors” (5.8 percent versus 1.3 percent) and more married women than married men place their careers as subordinate to their spouses’ careers (Hosek et al., 2001). In general, most women felt they were being forced to choose between family and a career in the military, a choice not as prevalent among their male peers.

Due to the cited reasons, Hosek et al. (2001) found that a “disproportionate number of women officers may be concluding that it is not worthwhile to continue to invest in a military career” (p.77). Overall, the authors conclude:

After weighing the questions of long-term career opportunities, the lack of full acceptance of their role by others and the institution, and conflictions with family responsibilities, many women concluded that the rewards of continued military service are less than the costs...Most saw their military service as a positive experience, and many who intended to separate expressed regret that they found it necessary to end their military career (p.101).

Two Naval Postgraduate School theses further chronicle the reasons women cite for leaving the Navy upon completion of minimum service requirements. These theses focus on women in the Surface Warfare and Aviation communities and are discussed below.



*a. Surface Warfare Community*

Clifton (2003) interviewed 15 junior (grades O-2 to O-3) and 12 senior (grades O-4 to O-6) female Surface Warfare Officers. The majority of the junior officers were intending to leave the Navy upon completion of their minimum service requirement or shortly thereafter. From the extensive interviews, four major themes emerged outlining the decision to stay in or leave the Navy: economic factors; Navy “taste factors”; leadership factors; and family issues. The most common negative factors junior officers provided as reasons for leaving the Navy were quality of life issues, lack of confidence in senior leadership, and family concerns.

Quality of life issues in the Surface Warfare community centered primarily around time spent at work and the inability to plan or schedule family and/or personal activities. Clifton (2003) states that “due to the vast amount of hours spent at work, many of the female junior officers feel that they cannot pursue other goals, such as time spent with family, and decide that they cannot stay in the Navy” (p.57).

Many of the junior officers cited poor leadership as their primary reason for leaving the Navy. They felt that informal recognition of their work was not offered enough and in general, felt underappreciated, particularly due to the long hours they spent at work. Issues of poor leadership are not new to retention studies. Hasty and Weber (2001) maintain that “contrary to popular belief, problems with retention in the military are a direct result of poor military leadership, not monetary issues” (in Clifton, 2003, p.29). Lieutenant Commander Wallace (1998) argues “junior officers are leaving a profession they love because they perceive that their leaders have failed to listen and act on their concerns. They are resigning in droves because they—and their position as officers—are no longer treated with the same respect as yesteryear” (in Clifton, 2003, p.30).

Finally, female junior officers in the Surface Warfare community list family concerns as a primary motivator for leaving the Navy. Most of the women interviewed by Clifton did not feel they could be successful, “on their own terms,” at both raising a family and being a SWO. Clifton’s (2003) findings are consistent with those of Hosek et al. (2001). Both researchers found that female junior officers are

choosing to leave the military due to feeling underappreciated and/or undervalued by their male superior officers and peers and due to family concerns, particularly marriage and the ability to have and raise children while pursuing a successful military career.

***b. Aviation Community***

Keegan (1999) interviewed 21 female aviators and Naval Flight Officers (NFO) who had had at least one sea-going deployment. The women were either Lieutenants or Lieutenant Commanders and each was a pioneer in Naval aviation. When the combat exclusions were lifted in 1993, the interviewed women were each the first, or only, female in at least one of their squadrons or assignments.

Most of the interviewees stated that their commitment to the Navy had lessened over the years due to plane assignment, lack of promotion opportunities, recent political policies, and the desire to have children and start a family. They also felt that they had no positive female role models, particularly senior officers who had successfully balanced an aviation career with raising a family. Nineteen of the twenty-one officers planned to leave the Navy after their minimum service requirement. Similar to the Clifton (2003) study, the women listed family, poor leadership, and quality of life as their primary reasons for leaving; many of the interviewees declared that the military is simply “not worth the trouble anymore” (Keegan, 1999, p.105).

**4. Summary**

Quantitative studies of female officer retention reveal that females have a higher propensity to leave the Navy upon completion of minimum service requirement than their male counterparts. In the DoD, women are 14 percent more likely to leave before promotion to O-4. In the Surface Warfare community, women are 50 percent more likely to leave than their male peers. Qualitative studies provide three primary reasons women cite for choosing to leave the Navy: poor quality of life, poor leadership, and family concerns. Poor quality of life and leadership include sexual harassment issues, feeling underappreciated and overworked, and not being considered as capable as male peers.

## **C. NAVAL ACADEMY SELECTION PROCESS**

### **1. Introduction**

Compared to civilian colleges and universities, the Naval Academy Admissions Board has the unique responsibility of selecting applicants who will not only succeed as students during their four years at the Academy but also as Navy and Marine Corps officers upon graduation. Thus, the Board of Admissions is essentially selecting future employees and it is their responsibility to choose applicants who are most likely to commit to a career in the Naval service. The Admissions Board attempts to ensure that every candidate selected for admission has “the capacity and desire to complete the four-year course and remain in the service beyond the period of obligated service after commissioning” (Foster and Pashneh-Tala, 2000, p.6).

### **2. Whole Person Multiple**

The Naval Academy Admissions Board uses a combination of quantitative and qualitative measures in its selection process. The Board uses an index called the Whole Person Multiple (WPM) to rank candidates for admission. The WPM is comprised of quantitative measures, included in the Candidate Multiple (CM), and qualitative measures, included in the Recommendation of the Admissions Board (RAB).

The CM is an algorithm computed from a candidate’s high school performance measures, including SAT or ACT scores, high school rank, participation in athletics and extracurricular activities, and recommendations from math and English teachers. The CM also includes scores from the Strong Interest Inventory, which is designed to determine whether a student has interest in a technical and/or military career. The CM algorithm is based on the Admissions Board’s history of selecting successful Navy and Marine Corps officers and is subject to change at the Board’s discretion. As of 2001, the components and weights of the CM were as follows:

- Rank in high school class (21%)
- Highest standardized SAT or ACT score for Math (31%)
- Highest standardized SAT or ACT score for English (15%)
- Combined Recommendation of School Official (RSO) – Math and English (8%)
- Combined athletic and non-athletic extra-curricular activities (10%)
- Strong Interest Inventory Technical Interest Score (12%)

- Strong Interest Inventory Career Interest Score (3%)

The raw CM score typically ranges from 50,000 to 77,000 (Foster and Pashneh-Tala, 2002; Phillips, 2004).

The WPM is the sum of the CM and RAB. When the Admissions Board sees something in a candidate's package that is not captured by the quantitative data in the CM, a RAB is added to the candidate's CM. RAB points are awarded when the Board feels a candidate has demonstrated exceptional potential for leadership and future success through subjective measures such as determination, character, and experience. Not all candidates receive a RAB, although its use and average score has been increasing over the years. Points are automatically given to special consideration groups including females, racial minorities, and applicants with non-Congressional nominations (Phillips, 2004). Other points are awarded at the discretion of the Board for the more subjective characteristics of leadership potential. RAB points must remain in the -500 to +9,000 point range; any RAB above 10,000 requires the approval of the Naval Academy Superintendent. Approximately 75 to 85 percent of each incoming class is awarded RAB points (Foster and Pashneh-Tala, 2002).

The Naval Academy's use of both quantitative and qualitative measures in its selection process is consistent with the admissions policies of many selective colleges and universities. A review of the graduate admissions process at Harvard University noted that quantitative modeling was "used to predict a reasonable cut-off for selection of candidates who should be considered in the next stage [of the selection process]," while qualitative measures were essential in estimating a "candidate's potential for educational leadership, depth of educational ideas, match with the program's strengths and resources, and motivation for embarking on a doctoral program" (Rogers, 2003, p.7). The WPM concept used by the Naval Academy is similar in design. The CM is used as a minimum cut-off for selection, while the RAB is increasingly used by the Admissions Board as a subjective measure of student potential.

### **3. Nomination Process**

Prior to application review by the Admissions Board, candidates must receive a nomination. The most common type of nomination is a Congressional nomination received from Senators or Representatives. There are numerous special nomination

sources, including Presidential or Vice Presidential, enlisted Navy and NROTC nominations, Superintendent of Naval Academy nomination, and the qualified alternate category nominated from the Admissions Board. All nomination categories except the direct Congressional nomination receive special recognition from the Board in the form of RAB points (Phillips, 2004).

#### **4. Predictive Success of Accession Metrics**

Despite the Admission Board's stated purpose of selecting candidates with the capacity and desire to remain in the Naval service beyond their minimum service obligation, the elements of the WPM used by the Admissions Board are designed to predict midshipman success while at the Naval Academy, not officer performance in the fleet or propensity for career service. Neumann and Abrahams (1989) noted that "although the Candidate Multiple is useful for predicting midshipmen performance, it has not included selection factors concerned with officer potential" (p.1). Despite the authors' recommendation for further study exploring the relationships between redesigned accession metrics and officer performance, and more importantly, officer retention, scarce research has been conducted in these areas.

##### ***a. Neumann and Abrahams (1989) and Rogers (2003)***

Neumann and Abrahams (1989) did begin research regarding the relationship between CM metrics and officer fleet performance. The authors found that scores for participation in high school extracurricular activities and teacher recommendations had the highest correlation with officer potential, defined as the likelihood of an officer being assigned a recommendation for early promotion (RAP) on fitness reports. This finding is consistent with those of Rogers (2003) who reported that the Military Performance grade of Naval Academy midshipmen is consistently the best predictor of fleet success measures. The Military Performance grade is assigned every semester to each midshipman. It is a weighted composite that includes grades in physical education, professional competency review, military performance, conduct, and professional courses. Thus, the best predictors of both midshipmen performance at the Naval Academy and officer performance in the fleet are the non-academic measures of high school athletic and non-athletic extracurricular activity participation and the

recommendation of high school teachers. The Naval Academy's Military Performance grade is similarly predictive of later fleet performance.

***b. Bowman and Mehay (2004)***

Bowman and Mehay (2004) sought to validate the use of the quantitative and qualitative elements of the WPM. The authors studied the relationship between the elements of the WPM and various Naval Academy success measures, including academic performance, military performance, and graduation for the 1995 to 2001 cohorts. They found that SAT scores are good predictors of academic performance but not military performance or graduation. Indeed, SAT verbal scores were found to be negatively correlated with graduation. This result has interesting repercussions as females typically have higher Verbal but lower Math SAT scores than their male peers.

In their study of qualitative metrics, Bowman and Mehay (2004) found that students who had received an alternative nomination source, i.e. not a direct Congressional nomination, were more likely to graduate. In a discussion of diversity and qualitative metrics, they note that females are less likely to graduate than males and confirm that it continues to be a challenge to “select females with a strong desire/motivation to graduate as quantitative admissions scores are not significant” (Slide 36). They recommend the Admissions Board search for new quantitative information specific to female graduation or increase the emphasis of the RAB portion of the WPM to give greater emphasis to information correlated with motivation to graduate.

***c. Phillips (2004)***

Phillips (2004) studied the role of the RAB in the admissions process and determined that there is value added from utilizing the qualitative information of RAB points. Each 500 points of RAB results in 0.4 percent increase in the probability of graduation from the Naval Academy. Phillips also found a significant interaction between CM and RAB. Interestingly, students with lower SAT scores and weaker high school grades/ranking but higher RAB scores are more likely to graduate than students with stronger high school academic performance. This is consistent with the results of Bowman and Mehay (2004) who found that students with non-direct nominations, and thus typically lower CM and higher RAB, are more likely to graduate. Phillips also found that Military Performance grades are closely related to the awarding of RAB points. As

shown by Rogers (2003), Military Performance scores are the best indicator of future fleet performance. Thus, it is likely that RAB scores are positively correlated with fleet performance.

*d. Burton and Ramist (2001)*

Burton and Ramist (2001) reviewed previous studies of the effect of high school grades and SAT scores on college performance. Consolidating the results of studies conducted on college graduating classes from 1980 to the mid-1990's, the authors found that while both high school record and SAT scores are both positively correlated with college performance, the combination of SAT scores and high school record is consistently the best predictor. Fewer studies have been conducted on the correlation between high school predictors and college graduation; however, the combination of high school record and SAT scores is again the best predictor, although the relationship is less significant and more moderate than that with cumulative college grades. High school record and test scores are equally successful predictors for males and females.

Few studies address the relationship between high school performance and non-academic measures of success, both in and after college. Non-academic success is defined as leadership; athletic, organizational, and civic accomplishments; overall faculty rating of success in college; and income after college. Burton and Ramist (2001) found that the traditional academic predictors, test scores and high school records, have moderate to no relationship to non-academic success. However, non-academic predictors, such as teacher recommendation letters, are the strongest predictors of non-academic success. These findings are similar to those of Neumann and Abrahams (1989), who found that participation in high school extracurricular activities and teacher recommendations are the best predictors of officer potential for Naval Academy graduates and those of Bowman and Mehay (2004) who found that SAT scores and high school grades predict academic success, but not necessarily military success. The finding also supports the use of RAB points in the Naval Academy admissions process. Burton and Ramist (2001) note that "the wide variety of talents and performances called for in college suggests that careful consideration should be given to including measures of a broad range of important academic and nonacademic skills and learning styles in the

admissions process” (p.26). RAB points provide the Board of Admissions this needed flexibility.

*e. Foster and Pashneh-Tala (2002)*

Foster and Pashneh-Tala (2002) researched the effect of personality measures from the Strong Interest Inventory (SII) on student attrition from the Naval Academy. The authors found that the Career Interest Score (CIS) of the SII is not significant in predicting attrition. If the CIS cannot predict Naval Academy attrition, it is of doubtful use in predicting future fleet retention. Although the CIS is not likely a useful predictor of fleet retention, it should be noted that it accounts for less than five percent of the CM. Foster and Pashneh-Tala did find, however, that the use of either the Myers-Briggs Type Indicator or Personal History Questionnaire in place of the CIS does improve the ability of the CM and WPM to predict voluntary attrition and could thus possibly be more valid predictors of fleet retention.

**5. Summary and Conclusion**

The WPM index used by the Naval Academy Admission’s Board to rank candidates is comprised of quantitative and qualitative metrics. The CM includes the quantitative measures of SAT scores, high school rank, participation in athletic and non-athletic extracurricular activities, recommendations of high school math and English teachers, and the Career Interest and Technical Interest Scores of the Strong Interest Inventory. The RAB includes a qualitative assessment by the Board that assesses future officer potential through a more subjective review of a candidate’s record.

Past research has shown that while SAT scores and high school rank are valid predictors of academics success at the Naval Academy, they are much less significant in predicting military performance at the Academy, graduation, and fleet performance. Better predictors of officer potential and fleet performance are participation in athletic and non-athletic extracurricular activities and the recommendations of teachers. There is no literature that explicitly studies the relationship between accession metrics and fleet retention past minimum service requirement.

Phillips (2004) notes that females are not treated differently in the Naval Academy admissions process as they do not have any significant differences in past performance. Phillips contends that “females who do graduate, all else being equal,



perform on par with the males...which suggest[s] that the Admissions Board is identifying and admitting females with the ability to succeed and perform well” (p.71). Unfortunately, while female performance at the Naval Academy is not different from that of males, career retention rates of men and women do differ significantly. The Admission Board may be identifying and admitting females with the ability to succeed and perform well at the Naval Academy but the Board has not been successful in selecting females with a propensity for extended service in the Navy and Marine Corps. This thesis will determine whether the Board should use different accession metrics or a re-weighting of current metrics for women in order to account for the significantly different fleet retention rates for men and women.

### **III. DATA AND METHODOLOGY**

#### **A. INTRODUCTION**

The methodology for research questions one and two, concerning the relationship between selection metrics and the retention of female officers, is discussed in this chapter. Chapter IV presents the regression results for this analysis. Chapter V includes the methodology and results for research question three, concerning the Navy's lateral transfer system.

#### **B. DATA AND SAMPLE**

All data were received from Professor William R. Bowman at the Naval Academy, Department of Economics. Naval Academy accession information was derived from data bases held by the Academy's Office of Institutional Research. Retention information was available through the Naval Officer Promotion History File and Loss File. The Promotion History File provides information on officers up to the O-4 promotion board while the Loss File provides career and demographic information for those officers who separate from the Navy.

Female officers from the Naval Academy 1988-1991 cohorts are analyzed by means of two separate samples. The first sample includes all women who entered the Naval Academy classes of 1988-1991. This sample includes 487 observations and is used to determine characteristics of women who graduate from the Academy. The second sample includes only those women who graduated from the Naval Academy. Upon removal of missing data, this sample includes 319 observations. Both samples include only those women who were offered and accepted admission to the Naval Academy. Data for individuals who applied but were not accepted or those who rejected an offer of admission are not available through the Office of Institutional Research.

#### **C. MODEL SPECIFICATION**

All multivariate logit models in this thesis have binary dependent variables. Thus, maximum likelihood techniques are used to estimate the logit models.

Multivariate regression Model 1 is used to determine the relationship between selection metrics and the probability of graduation from the Naval Academy. An understanding of the selection metrics/graduation relationship is important to better understand the relationship between selection metrics and future fleet retention as only those women who graduate and are commissioned have the opportunity to remain in the Navy beyond their minimum service requirement. The dependent variable is a binary variable that indicates graduation versus non-graduation. The independent variables include each element of the Whole Person Multiple, nomination source, and additional background information including minority status, athletic status, participation in a Naval Academy feeder program, and prior military service.

Regression Model 2 is used to determine the relationship between selection metrics and the probability of retention in the Navy beyond minimum service requirement for the sample of women who graduated. The dependent variable is a binary variable that indicates whether or not the individual was retained beyond minimum service requirement. Minimum service requirement is defined as ten years for pilots and seven years for all other designators. The independent variables include each element of the WPM, nomination source, minority status, athletic status, participation in a feeder program, prior military service, and additional career and demographic information including initial designator, and marital and dependency status. Model 3 is identical to Model 2 except that the dependent variable indicates retention to the O-4 promotion board, vice retention past minimum service requirement. Cohort dummy variables are included in all models to control for any unseen year group effects.

#### **D. VARIABLE DESCRIPTIONS**

Table 1 presents the variables used in the three models, followed by a more detailed description of how specific variables were created. The Designator variables and Career and Demographics Information variables are only included in the retention models (Models 2 and 3). All other variables are included in each of the three models.

**Table 1. Description of Dependent and Independent Variables**

<b>Variable Description</b>	<b>Variable Name</b>	<b>Variable Type</b>	<b>Range</b>
<u><b>Dependent Variables</b></u>			
Graduation	Grad	Binary	= 1 if graduated, = 0 if did not graduate
Retention past MSR	Retain	Binary	= 1 if retained past MSR, = 0 if not retained
Retention to O4 board	Lcstay	Binary	= 1 if retained to O4 board, = 0 if not retained
<u><b>Independent Variables</b></u>			
<u><b>Whole Person Multiple</b></u>			
Candidate Multiple/100	CM1	Continuous	507 to 756
RAB*CM(50,000-57,999)	RABlow	Continuous	0 to 15
RAB*CM(58,000-60,999)	RABmid1	Continuous	0 to 12
RAB*CM(61,000-64,999)	RABmid2	Continuous	0 to 14
RAB*CM(65,000-76,000)	RABhigh	Continuous	-2 to 8
SAT Math	SATM	Continuous	510 to 800
SAT Verbal	SATV	Continuous	530 to 800
High School Rank Percentile * 100	HSpct100	Continuous	0.17 to 91.3
English and Math Teacher Recommendation	EMREC	Continuous	342 to 999
Combined Athletic/Non-athletic Extracurricular Activities	CECA	Continuous	335 to 755
Technical Interest Score (SII)	TISSTD	Continuous	229 to 698
Career Interest Score (SII)	CISSTD	Continuous	187 to 741
<u><b>Nomination Source</b></u>			
Congressional		Binary	BASE CASE
Qualified Alternative	QualAlt	Binary	= 1 if Qualified Alternative, = 0 otherwise
Presidential	Pres	Binary	= 1 is Presidential, = 0 otherwise
Secretary of the Navy	SecNav	Binary	= 1 is SecNav, = 0 otherwise
Other	other_nom	Binary	= 1 is other nomination, = 0 otherwise
<u><b>Additional Selection Variables</b></u>			
Prior enlisted service	priorserv	Binary	= 1 if prior enlisted, = 0 if not prior enlisted
Minority	Minority	Binary	= 1 if minority, = 0 if White
Recruited varsity athlete	var_rec	Binary	= 1 if recruited varsity athlete, = 0 otherwise
Non-recruited varsity athlete	var_nonrec	Binary	= 1 if non-recruited varsity athlete, = 0 otherwise
Feeder	feeder1	Binary	= 1 if graduated from USNA feeder program, = 0 otherwise

**Table 1 (cont.). Description of Dependent and Independent Variables**

Variable Description	Variable Name	Variable Type	Range
<u>Designator</u>			
Fleet Support			BASE CASE
Surface Warfare	SWO	Binary	= 1 if SWO, = 0 otherwise
Aviation	Pilot	Binary	= 1 if pilot, = 0 otherwise
Naval Flight Officer	NFO	Binary	= 1 if NFO, = 0 otherwise
Civil Engineering Corps	CEC	Binary	= 1 if CEC, = 0 otherwise
Supply	Supply	Binary	= 1 if supply, = 0 otherwise
Other	Other	Binary	= 1 if other designator, = 0 otherwise
<u>Demographic Information</u>			
Marital status	Married	Binary	= 1 if married before O3 board, = 0 otherwise
Dependent status	Kids	Binary	= 1 if married with children, = 0 otherwise
<u>Other</u>			
Year group 1988			BASE CASE
Year group 1989	yr89	Binary	= 1 if year group 1989, = 0 otherwise
Year group 1990	yr90	Binary	= 1 if year group 1990, = 0 otherwise
Year group 1991	yr91	Binary	= 1 if year group 1991, =0 otherwise

## 1. Dependent Variables

### a. Retention to MSR

The *retain* variable was created by comparing the year of separation to the minimum service requirement for each observation. Minimum service requirement is defined as ten years for pilots and seven years for all other designators. If separation year was greater than or equal to minimum service requirement, *retain* = 1; otherwise, *retain* = 0.

### b. Retention to O-4 Board

The *lcstay* variable indicates whether an individual was retained to the O-4 promotion board. Promotion to O-4 typically occurs at the ten year point in service. Therefore, this variable represents a longer retention period than the *retain* variable.

## **2. Whole Person Multiple**

### ***a. Candidate Multiple***

The raw Candidate Multiple Score was divided by 100 and high school rank percentile was multiplied by 100 to express all variables in a similar range. This range was chosen to match that of the SAT, English/Math recommendation, and Strong Interest Inventory variables. The SAT math and verbal scores are the highest, not the average, scores for each individual. Low numbers for the high school rank percentile indicate superior academic performance in high school. The high school rank percentile was computed by dividing individual rank by size of the graduating class.

### ***b. Recommendation of Admissions Board***

RAB points were divided by 500. This aids in interpretation because RAB points are awarded in blocks of 500.

The RAB variables were created by interacting the RAB scores with dummy variables indicating in which of four ranges the individual's CM score fell. The four CM ranges were derived by Phillips (2004), who found definitive break points in the interaction of the RAB and CM scores. Break points were found at CM scores of 58,000; 61,000; and 65,000. RAB points are given across the entire range of CM scores; however, higher RABs are more common for lower CM scores ( $CM < 58,000$ ) to allow a candidate to be considered "qualified" by the Admissions Board. In the 61,000 to 65,000 range, candidates are considered qualified without RAB points; however, points are awarded for an applicant's unobservable traits that are considered desirable by the Admissions Board. Candidates with 65,000+ CM scores are fully qualified; RAB points are less common in this range and an individual may even receive negative RAB points.

Phillips (2004) found that the impact of RAB points on graduation differs significantly across CM ranges. CM scores in the  $>58,000$  range generally receive higher RAB points; however, the RAB points awarded to these applicants have "no impact on desire, motivation or ability to graduate" (p.50). The largest impact of RAB points on graduation is found in the middle range of the CM (61,000 to 65,000), particularly at the mean CM of 63,000. The impacts of RAB points on graduation for the 58,000 to 61,000 and 65,000+ ranges were also significant and positive, but had a smaller impact on graduation.

### **3. Nomination Source**

Congressional nominations are the base case for the nomination source variable; 40 percent of the observations have a Congressional nomination. The other nomination source variable (*other\_nom*) includes children of special military personnel, ROTC honor nominations, and nominations from the superintendent of the Naval Academy.

### **4. Additional Selection Variables**

The *minority* variable = 1 for all individuals who are not Caucasian, including observations that are African American, Asian American, Filipino, Hispanic, and Native American. Athletic status is broken into three categories: non-varsity athlete, recruited varsity athlete, and non-recruited varsity athlete. Non-athletes are the base case. The *feeder* variable indicates whether the individual graduated from a Naval Academy feeder program. The sample includes individuals who participated in BOOST, NAPS, and the Naval Academy Foundation. Fourteen percent of the sample participated in a feeder program, including 0.5% BOOST, 7.5% NAPS, and 6% Foundation.

### **5. Designator**

The designator variables indicate an individual's designator at time of commissioning. Fleet Support is the base case for the designator variables, encompassing almost one-third of the sample. The *other* designator variable includes all designators that contain less than ten observations, including Special Operations, Aviation Engineering Duty, Cryptology, Intelligence, Oceanography, and Engineering Duty.

### **6. Demographic Information**

The marital status variable (*married*) indicates whether the individual is married at the time of the O-3 board. The dependency status variable (*kids*) indicates any dependents in addition to the spouse. Both variables are binary in nature. There was not enough variation in the number of children to allow for *kids* to be a continuous variable.

## **E. HYPOTHESIZED RELATIONSHIPS**

Table 2 presents hypothesized relationship for the independent variables. These relationships are derived from past studies that are presented in the literature review and discussed below.

**Table 2. Hypothesized Relationships for Graduation and Retention Outcomes**

<b>Variable</b>	<b>Graduation</b>	<b>Retention</b>
<i><u>Whole Person Multiple</u></i>		
RAB*CM(50,000-57,999)	+	+
RAB*CM(58,000-60,999)	+	+
RAB*CM(61,000-64,999)	+	+
RAB*CM(65,000-76,000)	+	+
SAT Math	+	?
SAT Verbal	-	?
High School Rank Percentile * 100	+	?
English and Math Teacher Recommendation	+	+
Combined Athletic/Non-athletic Extracurricular Activities	+	+
Technical Interest Score (SII)	?	?
Career Interest Score (SII)	?	?
<i><u>Nomination Source</u></i>		
Qualified Alternative	+	?
Presidential	+	?
Secretary of the Navy	+	?
Other	+	?
<i><u>Additional Selection Variables</u></i>		
Prior enlisted service	?	+
Minority	-	-
Recruited varsity athlete	+	-
Non-recruited varsity athlete	+	+
Feeder	?	?
<i><u>Designator</u></i>		
Fleet Support	N/A	?
Surface Warfare	N/A	-
Aviation	N/A	?
Naval Flight Officer	N/A	?
Civil Engineering Corps	N/A	?
Supply	N/A	?
Other	N/A	?
<i><u>Demographic Information</u></i>		
Marital status	N/A	-
Dependent status	N/A	-



## **1. Graduation Decision**

By definition, all elements of the WPM should have a positive relationship with graduation. Previous research has supported all of these relationships except for that of the SAT verbal score. Bowman and Mehay (2004) found SAT verbal scores to be negatively correlated with graduation. There are no hypothesized relationships for the Career Interest and Technical Interest Scores of the Strong Interest Inventory. Foster and Pashneh-Tala (2002) found no relationship between the CIS and attrition from the Naval Academy; the predictive effects of the CIS and TIS on fleet retention are thus also unpredictable. Bowman and Mehay (2004) also found that students who had received other-than-Congressional nominations were more likely to graduate, resulting in the positive relationships for the nomination sources.

The effect of prior enlisted service on graduation is mixed. Prior service prepares individuals for a military environment and thus could have a positive effect on graduation. However, individuals with prior service typically have weaker academic backgrounds which may not adequately prepare them for the rigors of the Naval Academy academic program. The effect of feeder programs is similarly ambiguous. The feeder programs prepare individuals for the academic and military challenges at the Naval Academy; however, individuals who participate in the feeder programs do so due to weaker academic backgrounds. Minorities have historically had a lower rate of graduation than non-minorities. On the other hand, varsity athletes, both recruited and non-recruited, have a greater likelihood of graduation than non-athletes (Robbins, 2004).

## **2. Retention Decision**

RAB points are hypothesized to have a positive relationship with fleet retention due to the positive relationship between RAB points and military performance at the Naval Academy, measured by the CMQPR, and the subsequent positive relationship between CMQPR and fleet performance and retention (Phillips, 2004; Rogers, 2003).

Burton and Ramist (2001) found that non-academic predictors, such as teacher recommendations and participation in extra-curricular activities, are the only valid predictors of non-academic success during and after college. Thus English/Math teacher recommendation scores and athletic/non-athletic extra-curricular activities scores are

hypothesized to have a positive relationship with retention beyond minimum service requirement.

Due to lack of previous research, two-sided tests will be performed for the remainder of the WPM elements and the nomination source variables.

Prior enlisted service is expected to have a positive relationship with fleet retention. Officers who have invested time in the military prior to college are more likely to remain until retirement. Minority status is expected to have a negative impact on retention. Studies have found that minorities often find it difficult to develop the mentoring relationships considered necessary for career service and thus leave the service at higher rates than their white peers (Hosek et al., 2001). Robbins (2004) found that status as a varsity athlete has a positive effect on fleet retention; however, this is slightly counterbalanced by the negative relationship between retention rates and recruited varsity-athlete status. The relationship between feeder programs and retention beyond minimum service requirement is unknown.

The only hypothesized relationship for the designator variables is for the Surface Warfare community. The hypothesized negative relationship is due to the historically low rates of female SWO retention.

Marital status and dependency status are hypothesized to have negative relationships with fleet retention, as evidenced by the number of female junior officers who cite family obligations as a primary reason for leaving the Naval service.

## **F. PRELIMINARY DATA ANALYSIS**

### **1. Nomination Source**

Cross-tabulation of nomination sources and the WPM and athletic status variables (Table 3) reveals important patterns.

**Table 3. Cross-tabulation of Nomination Source and Selection Metrics**

		<b>Congress</b>	<b>Qual Alt</b>	<b>President</b>	<b>SecNav</b>	<b>Other</b>
Candidate Multiple	Mean	65,219	62,089	62,384	60,239	61,499
RAB	Mean	643	1073	1053	683	1176
SAT Math	Mean	662	646	635	617	641
SAT Verbal	Mean	688	651	655	641	635
High School Rank Pct * 100	Mean	5.5	8.5	7.9	15.4	15.0
English/Math Recommendation	Mean	890	896	902	925	893
Extracurricular Activities	Mean	545	539	526	521	537
Technical Interest Score	Mean	448	466	454	464	489
Career Interest Score	Mean	504.8	489	489	518	495
Recruited varsity athlete	%	15.0	47.5	21.1	10.0	35.3
Non-recruited varsity athlete	%	45.6	28.2	52.6	66.7	29.4

Candidates with Congressional nominations have higher overall CM scores than those with other-than-Congressional nominations. Congressional nominations also tend to have higher SAT scores, lower high school percentile (indicating a higher high school graduating rank), slightly lower English/Math teacher recommendation scores, and lower Technical Interest scores but higher Career Interest scores. RAB points are automatically given to candidates without a Congressional nomination; thus it is not surprising that Congressional nominations have the lowest average RAB points of all nomination categories. This also supports the notion that RAB points are often awarded to candidates with lower quantitative scores who demonstrate potential not evident in the CM. Finally, Congressional nominations have a smaller likelihood of being a recruited varsity athlete but an average likelihood of being a non-recruited varsity athlete.

The Presidential, Qualified Alternate and Other nomination categories have significantly higher RAB points than the Congressional and Secretary of the Navy nomination sources. The Admissions Board is clearly rewarding these candidates for qualitative attributes gleaned from their applications. Further analysis will reveal whether the Board is successfully selecting women with a propensity for graduation and fleet retention.

The Qualified Alternate and Other nomination sources have the largest number of recruited athletes. Once again, the Board is actively seeking these candidates and rewarding them with RAB points and other-than-Congressional nominations.

Finally, candidates in the Qualified Alternate and Presidential categories appear quite similar, on average. It is not apparent why candidates are awarded Qualified Alternate versus Presidential nominations.

## 2. Graduation Decision

Table 4 describes the sample used to analyze the graduation decision. Significant differences between the graduate and non-graduate groups are indicated in bold.

**Table 4. Characteristics of Female Officers by Graduation Outcome**

Variable	Value	Full Sample	Graduate	Did Not Graduate	Chi-sq/t test p-value
Graduation	%		69.8	30.2	
RAB*CMlow	Mean	0.6899	0.6941	0.6803	0.9556
RAB*CMmid1	Mean	0.2813	0.2941	0.2517	0.6404
RAB*CMmid2	Mean	0.4517	<b>0.3294</b>	<b>0.7347</b>	<b>0.0279</b>
RAB*CMhigh	Mean	0.3142	0.3088	0.3265	0.8632
SAT Math	Mean	649	<b>653</b>	<b>642</b>	<b>0.0345</b>
SAT Verbal	Mean	666	666	665	0.8236
High School Rank Pct * 100	Mean	7.8	7.5	8.4	0.3950
English/Math Recommendation	Mean	896	897	894	0.7005
Extracurricular Activities	Mean	538.5	<b>542.3</b>	<b>529.7</b>	<b>0.0623</b>
Technical Interest Score	Mean	457.6	459.6	452.9	0.4702
Career Interest Score	Mean	497.5	<b>492.7</b>	<b>508.5</b>	<b>0.0861</b>
Congressional nomination	%	42.3	40.9	45.6	0.3356
Qual Alternative nomination	%	36.3	37.4	34.0	0.4819
Presidential nomination	%	11.7	12.1	10.9	0.7113
SecNav nomination	%	6.2	7.1	4.1	0.2097
Other nomination	%	3.5	2.6	5.4	0.1229
Prior enlisted service	%	6.6	<b>7.9</b>	<b>3.4</b>	<b>0.0634</b>
Minority	%	18.5	18.2	19.0	0.8321
Recruited varsity athlete	%	27.9	<b>33.2</b>	<b>15.6</b>	<b>&lt;.0001</b>
Non-recruited varsity athlete	%	40.9	<b>46.5</b>	<b>27.9</b>	<b>0.0001</b>
Feeder program	%	14.2	<b>15.9</b>	<b>10.2</b>	<b>0.0990</b>
Year group 1989	%	26.7	25.9	28.6	0.5380
Year group 1990	%	28.3	28.2	28.6	0.9398
Year group 1991	%	23.6	23.8	23.1	0.8685
Number of observations		487	340	147	

Contrary to previous research (Phillips, 2004), RAB points do not appear to have a positive relationship with graduation. Of the four CM/RAB interaction variables, only the RAB\*CM(61,000-64,999) is significant. Furthermore, individuals who do not graduate have significantly higher RAB points for this range of the CM. This indicates that the Admissions Board is awarding points to individuals who are less likely to graduate.

Individuals who graduate have higher math SAT scores than those who do not graduate, on average. This supports the hypothesized relationship and is similar to results of previous research. Although Bowman and Mehay (2004) found that verbal SAT scores have a negative relationship with graduation, there is no significant difference in the two groups for the female-only sample.

Other significant differences between the graduate and did-not-graduate groups include extra-curricular activities score; Career Interest Score; prior enlisted service; varsity athletic status, both recruited and non-recruited; and participation in a feeder program. Individuals with higher extra-curricular activities scores are more likely to graduate. Interestingly, those who score higher on the Career Interest Inventory are less likely to graduate. Combined with the results of Foster and Pashneh-Tala (2002), the Strong Interest Inventory does not seem to be a valid predictor of midshipman success and its inclusion in the WPM metric is problematic.

Women varsity athletes, both recruited and non-recruited, are much more likely to graduate than non-athletes. This is consistent with both the hypothesized relationships and previous research. Finally, those who participate in a feeder program are more likely to graduate, indicating that the positive elements of the programs compensate for the weaker academic backgrounds of the participants.

None of the other variables, including nomination source, English/Math recommendation scores, and high school percentile, reveal significant differences between the graduate and did-non-graduate groups.

### **3. Retention Decision**

Tables 5 and 6 describe the sample used to analyze the retention decision, with retention defined as remaining in the Navy past minimum service requirement and until the O-4 promotion board, respectively.

**Table 5. Characteristics of Female Officers by Decision to Retain Past Minimum Service Requirement**

<b>Variable</b>	<b>Value</b>	<b>Full Sample</b>	<b>Retain</b>	<b>Did Not Retain</b>	<b>Chi-sq/t test p-value</b>
Retention	%		46.4	53.6	
RAB*CMlow	Mean	0.6426	0.5743	0.7017	0.6012
RAB*CMmid1	Mean	0.3103	0.3108	0.3099	0.9948
RAB*CMmid2	Mean	0.3323	0.3378	0.3275	0.9400
RAB*CMhigh	Mean	0.3009	0.3446	0.2632	0.4652
SAT Math	Mean	653	655	651	0.4604
SAT Verbal	Mean	665	663	667	0.5773
High School Rank Pct * 100	Mean	7.12	7.66	6.65	0.3326
English/Math Recommendation	Mean	896	905	889	0.1188
Extracurricular Activities	Mean	542	547	538	0.5588
Technical Interest Score	Mean	459	466	452	0.1843
Career Interest Score	Mean	492	496	489	0.5588
Congressional nomination	%	40.4	38.5	42.1	0.5145
Qual Alternative nomination	%	38.2	35.1	40.9	0.2877
Presidential nomination	%	11.9	<b>15.5</b>	<b>8.8</b>	<b>0.0627</b>
SecNav nomination	%	6.6	7.4	5.8	0.5693
Other nomination	%	2.8	3.4	2.3	0.5762
Prior enlisted service	%	6.9	<b>10.1</b>	<b>4.1</b>	<b>0.0337</b>
Minority	%	18.2	20.3	16.4	0.3683
Recruited varsity athlete	%	33.2	35.1	31.6	0.5013
Non-recruited varsity athlete	%	46.4	44.6	48.0	0.5486
Feeder program	%	15.4	15.5	14.6	0.8186
SWO	%	13.2	13.5	12.9	0.8645
Aviation	%	14.1	14.2	14.0	0.9685
NFO	%	6.6	<b>10.1</b>	<b>3.5</b>	<b>0.0173</b>
CEC	%	6.6	7.4	5.8	0.5693
Supply	%	14.4	<b>8.8</b>	<b>19.3</b>	<b>0.0077</b>
Other designation	%	10.7	8.8	12.3	0.3128
Marital status	%	31.0	28.4	33.3	0.3401
Dependents status	%	2.2	2.0	2.3	0.8995
Year group 1989	%	26.3	23.0	29.2	0.2050
Year group 1990	%	28.5	27.0	29.8	0.5811
Year group 1991	%	22.6	23.0	22.2	0.8729
Number of observations			148	171	

**Table 6. Characteristics of Female Officers by Decision to Retain to O-4 Promotion Board**

Variable	Value	Full Sample	Retain	Did Not Retain	Chi-sq/t test p-value
Retention	%		36.7	63.3	
RAB*CMlow	Mean	0.6426	0.5897	0.6733	0.7406
RAB*CMmid1	Mean	0.3103	0.3248	0.3020	0.8690
RAB*CMmid2	Mean	0.3323	0.3590	0.3168	0.7671
RAB*CMhigh	Mean	0.3009	0.2650	0.3218	0.6288
SAT Math	Mean	653	655	652	0.6270
SAT Verbal	Mean	665	667	664	0.7138
High School Rank Pct * 100	Mean	7.11	7.49	6.90	0.5832
English/Math Recommendation	Mean	896	904	892	0.2201
Extracurricular Activities	Mean	542	541	543	0.7739
Technical Interest Score	Mean	459	470	452	0.1024
Career Interest Score	Mean	492	493	492	0.9081
Congressional nomination	%	40.4	41.0	40.1	0.8709
Qual Alternative nomination	%	38.2	31.6	42.1	0.0641
Presidential nomination	%	11.9	15.4	9.9	0.1451
SecNav nomination	%	6.6	9.4	5.0	0.1223
Other nomination	%	2.8	2.6	3.0	0.8328
Prior enlisted service	%	6.9	<b>12.0</b>	<b>4.0</b>	<b>0.0065</b>
Minority	%	18.2	19.7	17.3	0.6029
Recruited varsity athlete	%	33.2	33.3	33.2	0.9759
Non-recruited varsity athlete	%	46.4	46.2	46.5	0.9476
Feeder program	%	15.0	15.4	14.9	0.8979
SWO	%	13.2	9.4	15.3	0.1302
Aviation	%	14.1	<b>23.1</b>	<b>8.9</b>	<b>0.0005</b>
NFO	%	6.6	8.5	5.4	0.2817
CEC	%	6.6	6.8	6.4	0.8890
Supply	%	14.4	<b>6.8</b>	<b>18.8</b>	<b>0.0033</b>
Other designation	%	10.7	11.1	10.4	0.8419
Marital status	%	31.0	26.5	33.7	0.1823
Dependents status	%	2.5	1.7	3.0	0.2139
Year group 1989	%	26.3	24.8	27.2	0.6333
Year group 1990	%	28.5	23.9	31.1	0.1666
Year group 1991	%	22.6	24.8	21.3	0.4712
Number of observations			117	202	

Tables 5 and 6 reveal that very few of the selection metrics have a significant impact on the retention decision. Based on the differences between the means of the two groups, none of the Whole Person Multiple elements have a relationship with fleet retention, both for retention past minimum service requirement and retention to the O-4

board. There is limited research concerning the relationship between selection metrics and retention; nevertheless, these preliminary findings are not consistent with the research that is available. RAB points appear to have no impact on retention decision. Similarly, teacher recommendation and extracurricular activities scores have no effect, a preliminary finding that is inconsistent with the results of Burton and Ramist (2001) who found that non-academic predictors, such as teacher recommendations and participation in extracurricular activities, are the strongest predictors of non-academic success after college.

Varsity athletic status also does not have an effect on the retention decision of female officers. This is inconsistent with previous research. Using a mixed gender sample of Naval Academy graduates, Robbins (2004) found that non-recruited varsity athletes are more likely to remain in the Navy past minimum service requirement, while recruited varsity athletes are less likely to retain.

Significant differences in the decision to retain past minimum service requirement are only found for the Presidential nomination, prior enlisted service, and the NFO and supply designator variables. A Presidential nomination appears to have a positive impact on retention, as does prior enlisted service. Naval Flight Officers are more likely retain while Supply Officers are more likely to leave the Navy upon minimum service requirement. This may reflect differences in job opportunities in the civilian sector for the two designators

Differences in the decision to retain to the O-4 board are found only for the prior enlisted service, aviation, and supply variables. Once again, individuals with prior enlisted service are more likely to remain in the Navy, a result that is consistent with the hypothesized relationship. Pilots are more likely to retain to O-4, while Supply Officers are less likely to retain.

#### **4. Summary of Descriptive Statistics**

Preliminary data analysis reveals that selection metrics appear to have a limited relationship with graduation and retention decisions for female officers. These results are inconsistent with previous research conducted on male-only and mixed gender samples.



For the graduation decision, RAB points have either a negative or insignificant impact on graduation, while math SAT scores, participation in extracurricular activities, varsity athletic status at the Naval Academy, prior enlisted service, and participation in a USNA feeder program all appear to have positive relationships with graduation. Nomination source is not related to the graduation decision.

None of the Whole Person Multiple elements have a significant impact on the retention decision. Consistent with prior research and the hypothesized relationship, individuals with prior enlisted service are more likely to retain. Supply Officers appear less likely to retain, while NFOs are more likely to retain. Finally, females with a Presidential nomination are more likely to retain past minimum service requirement.

## **IV. DATA ANALYSIS AND RESULTS**

### **A. GRADUATION RESULTS**

#### **1. Discussion of Partial Effects for Graduation Decision**

The estimation results for the graduation model are presented in Table 7. The partial effects indicate the difference in the probability of graduation for a change in each variable compared to the base case. The base case can be considered an “average” candidate who has mean scores for each of the CM elements, no RAB points, and a Congressional nomination. In addition, the base case is white, has no prior enlisted service, is not a varsity athlete, and did not participate in a feeder program. The overall probability of graduation for the base case is 0.464.

**Table 7. Regression Estimates and Partial Effects for Graduation Decision**

<b>Variable</b>	<b>Parameter Estimate</b>	<b>Partial Effect</b>
Intercept	-7.1574**	----
RAB*CMlow	-0.0329	-0.0082
RAB*CMmid1	0.0944	0.0236
RAB*CMmid2	<b>-0.1852**</b>	<b>-0.0456</b>
RAB*CMhigh	-0.0129	-0.0032
SAT Math	<b>0.0076***</b>	<b>0.0946</b>
SAT Verbal	0.0018	0.0223
High School Rank Pct * 100	-0.0180	-0.0045
English/Math Recommendation	0.0002	0.0023
Extracurricular Activities	0.0027	0.0342
Technical Interest Score	-0.0012	-0.0152
Career Interest Score	0.0000	0.0001
Qual Alternative nomination	-0.0652	-0.0162
Presidential nomination	0.1564	0.0391
SecNav nomination	0.4973	0.1234
Other nomination	-0.4130	-0.0998
Prior enlisted service	<b>0.9009*</b>	<b>0.2166</b>
Minority	-0.0560	-0.0139
Recruited varsity athlete	<b>2.1764***</b>	<b>0.4202</b>
Non-recruited varsity athlete	<b>1.5627***</b>	<b>0.3411</b>
Feeder program	0.2696	0.0673
Year group 1989	-0.0874	-0.0217
Year group 1990	-0.0244	0.0061
Year group 1991	-0.2927	-0.0715
Number of observations	487	
R-squared	0.2511	
Likelihood Ratio: test for fit	p<.0001	
* Significant at .1, ** Significant at .05, ***Significant at .01		

The parameter estimates in bold are statistically significant. Very few of the selection metrics were significant in determining the probability of graduation. These results are not generally consistent with previous research that was conducted on samples of all men and mixed samples of men and women at the Naval Academy. In Table 7, only math SAT scores, one of the RAB variables, prior enlisted service, and athletic status are significant predictors of graduation.

The partial effect of math SAT scores indicates that for every 50-point increase in the math SAT score, the probability of graduation increases by 9.46 percentage points

(ppts). This result is consistent with previous research which has consistently found a positive and significant relationship between math SAT scores and graduation. The effect of varsity athletic status is also consistent with previous research. Participation in a varsity sport, whether as a recruited or non-recruited athlete, increases the probability of graduation (Robbins, 2004). This is due to both the additional leadership opportunities gained through athletic participation and the emotional support provided by coaches and other members of the athletic team. Recruited varsity athletes are 42.0 ppts more likely to graduate than non-athletes, while non-recruited varsity athletes are 34.1 ppts more likely to graduate. These two results seem implausibly high since the overall graduation probability is only 0.46. Finally, individuals with prior enlisted service are 21.7 ppts more likely to graduate than those without prior service. This result seems to indicate that the experience gained through enlisted service more than compensates for the weaker academic backgrounds of these individuals.

Although only the math SAT score element of the CM is a significant predictor of the probability of graduation, the CM elements are jointly significant (Chi-square=15.06,  $p=0.0352$ ). Nevertheless, compared to previous research, the CM is not as effective in determining the probability of graduation for women as it is for men (Phillips, 2004; Bowman and Mehay, 2004).

Only one of the four RAB variables is significant; for those individuals with CM scores in the 61,000 to 65,000 range, a 500 point increase in the RAB score results in the probability of graduation decreasing by 4.6 ppts. In addition, the RAB variables are not jointly significant in predicting graduation (Chi-square=7.276,  $p=.1221$ ). This indicates that the Admissions Board is awarding RAB points to individuals with apparent potential for success but these individuals are actually less likely to graduate. The insignificant or negative effect of the RAB variables is not consistent with previous research. Phillips (2004) and Bowman and Mehay (2004), who used mixed gender samples, found that RAB points have a significant and positive effect on probability of graduation, particularly in the mean CM range (61,000 to 65,000).

None of the nomination source variables are significant. This is contrary to the hypothesized relationships and past research. Using a mixed gender sample, Bowman

and Mehay (2004) found that other-than-Congressional nominations had a greater probability of graduation. Nevertheless, nomination source does not appear to have a significant impact on probability of graduation for women at the Naval Academy. The insignificance of the Career Interest and Technical Interest Scores are also consistent with the research of Foster and Pashneh-Tala (2002) who found no relationship between results on the Strong Interest Inventory and likelihood of graduation.

## **2. Reasons for Leaving Naval Academy**

An analysis of leave codes indicates that almost 60 percent of the women who did not graduate left the Naval Academy voluntarily. Academic reasons accounted for 23 percent of the non-graduates and an additional 13 percent were involuntary separated. The small remainder did not graduate for medical reasons. The large percentage of voluntary separations seems to indicate that cultural reasons are causing the low graduation rates for women, compared to men. Failure to graduate does not appear to be caused by academic or athletic “performance gaps,” as the females who are accepted to the Naval Academy display similar, if not superior, scores in most metrics (Bowman and Mehay, 2004). Rather, low female graduation rates appear to be caused by differences in how females view the historically male-oriented and dominated culture of the Naval Academy. Finding it difficult to fit into this male environment, most women are choosing to leave voluntarily.

## **B. RETENTION DECISION**

Table 8 presents the estimation results for the retention to minimum service requirement and retention to O-4 models. Significant variables are indicated in bold. The partial effects indicate the percentage point change in probability of retention due to a change in the variable compared to the base case. The base case is a female with a mean score for each CM element, no RAB points, and a Congressional nomination. This individual is also white, has no prior enlisted service, is not a varsity athlete, did not participate in a feeder program, has a Fleet Support designator, and is single with no dependents. The probability of retention for the base case is 0.5639 for retention to minimum service requirement and 0.5248 for retention to the O-4 promotion board.

**Table 8. Regression Estimates and Partial Effects for Retention to MSR and Retention to O-4**

	Retention to MSR			Retention to O-4	
<b>Variable</b>	<b>Parameter Estimate</b>	<b>Partial Effect</b>		<b>Parameter Estimate</b>	<b>Partial Effect</b>
Intercept	-8.4314	----		-5.1883	----
RAB*CMlow	-0.0493	-0.0120		-0.0422	-0.0101
RAB*CMmid1	0.0172	0.0057		0.0739	0.0176
RAB*CMmid2	0.0218	0.0024		0.0437	0.0103
RAB*CMhigh	0.0893	0.0158		-0.0877	-0.0231
SAT Math	<b>0.0046**</b>	<b>0.0516</b>		0.0015	0.0195
SAT Verbal	0.0011	0.0215		0.0023	0.0279
High School Rank Pct * 100	0.0139	0.0034		-0.0021	-0.0007
English/Math Recommendation	<b>0.0026*</b>	<b>0.0374</b>		0.0022	0.0269
Extracurricular Activities	<b>0.0044**</b>	<b>0.0604</b>		0.0007	0.0090
Technical Interest Score	0.0004	0.0039		0.0014	0.0157
Career Interest Score	0.0004	0.0068		-0.0004	0.0054
Qual Alternative nomination	-0.2122	-0.0638		<b>-0.6157**</b>	<b>-0.1518</b>
Presidential nomination	<b>0.8681**</b>	<b>0.1830</b>		0.5256	0.1292
SecNav nomination	-0.1471	-0.0498		0.4571	0.1131
Other nomination	0.0837	-0.0214		-0.9381	-0.2234
Prior enlisted service	<b>1.4982**</b>	<b>0.2698</b>		<b>1.4001**</b>	<b>0.2938</b>
Minority	<b>0.6915*</b>	<b>0.1753</b>		0.6117	0.1462
Recruited varsity athlete	0.1340	0.0078		0.2175	0.0489
Non-recruited varsity athlete	-0.4687	-0.1200		-0.4961	-0.1271
Feeder program	-0.1081	-0.0245		-0.1056	-0.0346
Surface Warfare	-0.2513	-0.0873		<b>-0.7788*</b>	<b>-0.1863</b>
Aviation	-0.1365	0.0065		<b>1.1402***</b>	<b>0.2553</b>
Naval Flight Officer	-1.2491	0.2144		0.2513	0.0736
Civil Engineering Corps	0.0244	0.0615		0.1329	0.0304
Supply	<b>-1.2491***</b>	<b>-0.2563</b>		<b>-1.4068***</b>	<b>-0.3131</b>
Other designator	<b>-0.7765**</b>	<b>-0.0065</b>		-0.0925	0.0121
Marital status	-0.3206	-0.0818		<b>-0.5568*</b>	<b>-0.1353</b>
Dependent status	-0.1367	-0.0192		-0.9218	-0.2155
Year group 1989	-0.5692	-0.1319		-0.3219	-0.0811
Year group 1990	-0.4389	-0.0874		-0.4432	-0.1145
Year group 1991	-0.3660	-0.0896		-0.1152	-0.0301
Number of observations	319			319	
R-squared	0.1715			0.2145	
Likelihood Ratio: test for fit	0.0632			0.0058	
* Significant at .1, ** Significant at .05, ***Significant at .01					

## **1. Discussion of Partial Effects for Retention Decision**

### ***a. Retention to Minimum Service Requirement***

Few selection metrics are significant for retention to minimum service requirement. Math SAT scores have a positive effect on retention, as do teacher recommendation scores, participation in extracurricular activities, a Presidential nomination, prior enlisted service, and minority status. A 50-point increase in the math SAT score results in a 5.16 ppt increase in the probability of retention. Fifty point increases in the teacher recommendation score and extracurricular activities participation score result in 3.74 ppt and 6.04 ppt increases in the likelihood of retention, respectively. The significance of the teacher recommendation and extracurricular activities scores are consistent with past research conducted on mixed gender and male-only samples. Neumann and Abrahams (1989) and Burton and Ramist (2001) found that non-academic predictors, such as recommendation letters and participation in extracurricular activities, are the strongest predictors of non-academic success, including performance and income after college.

None of the RAB variables are significant, a result that is contrary to the hypothesized relationship and previous research. This seems to indicate that the Admissions Board is awarding qualitative points to women for leadership and developmental potential; however, these women are not more likely to remain in the Navy. Also, tests of joint significance for the CM elements (Chi-square=8.9881,  $p=0.2535$ ) and RAB variables (Chi-square=0.9999,  $p=0.9098$ ) indicate that these variables are not jointly significant. The WPM metric does not appear to be effective in selection women with a propensity for extended Naval service.

In addition, the nomination source variables are not jointly significant (Chi-square=6.0325,  $p=0.1967$ ). However, compared to women with Congressional nominations, those with Presidential nominations are 18.30 ppts more likely to retain past minimum service requirement. Contrary to the results of research conducted on a mixed gender sample (Robbins, 2004), participation in varsity athletics has no impact on the probability of retention. Prior enlisted service and minority status increase the likelihood of retention past minimum service requirement by 26.98 ppts and 17.53 ppts,

respectively. The result for minorities is contrary to previous research which found that minorities are less likely to retain than whites (Hosek et al., 2001).

Finally, the designator variables are jointly significant (Chi-square=14.2172,  $p=0.0273$ ) revealing that community has a significant impact on women's decisions to remain in the Navy. Compared to Fleet Support officers, Supply officers are 25.63 ppts less likely to retain while women with "other" designators, including Oceanography, Intelligence, Public Affairs, Cryptology, and Special Operations, are 0.65 ppts less likely to retain.

***b. Retention to O-4 Promotion Board***

Even fewer of the selection metrics are significant for retention to O-4. None of the WPM elements are significant and tests of joint significance reveal that the CM elements are not jointly significant (Chi-square=3.8486,  $p=0.7970$ ) nor are the four RAB/CM interaction variables (Chi-square=1.4548,  $p=0.8346$ ). These results clearly indicate that the current selection metrics used by the Naval Academy do not predict women's decisions to remain in the Navy to the O-4 paygrade. Only the Qualified Alternate nomination and prior enlisted service variables have a significant effect on decision to remain in the Navy. Compared to women with a Congressional nomination, those with a Qualified Alternate nomination have a 0.15 lower probability to retain. This indicates that the Admissions Board is nominating women with a lower propensity for extended Naval service. The nomination source variables are jointly significant (Chi-square=8.612,  $p=0.0716$ ) indicating that nomination source does have an effect on probability of retention. This result is consistent with past research (Bowman and Mehay, 2004); however, previous research conducted on mixed gender samples had more significant results for individual nomination variables, not just joint significance. Once again, prior enlisted service has a significant and positive effect on retention. Women with prior service are 29.4 ppts more likely to remain in the Navy to O-4 than those without prior service.

Three of the designator variables are individually significant and all of the designator variables are jointly significant (Chi-square=24.02,  $p=0.0005$ ). Compared to Fleet Support officers, Surface Warfare Officers are 18.63 ppts less likely to retain, pilots are 25.53 ppts more likely to retain, and Supply officers are 31.31 ppts less likely to



retain. The results for SWOs are consistent with past research and current statistics that reveal the low propensity for female SWOs to remain in the Navy to the O-4 paygrade. The large partial effect for the aviation designator may be due to the long minimum service requirement for aviators. This long requirement is not as evident in the MSR model because pilots were coded as having longer requirements than the other designators. Finally, Supply officers are less likely to retain; this may be due to more opportunities in the civilian workforce, as compared to Fleet Support officers.

Finally, women who are married are 13.53 ppts less likely to remain in the Navy than those who are single. This result is consistent with past research; women often cite family obligations as a primary reason for leaving the Navy (Clifton, 2003; Hosek et al, 2001).

## **2. Summary of Results for Retention Decision**

Limited elements of the WPM metric are significant predictors of the decision to remain in the Navy for female officers. Math SAT scores, teacher recommendation scores, and participation in extracurricular activities have positive and significant relationships with retention past minimum service requirement. However, none of the WPM elements are significant in explaining retention to O-4. The analysis of nomination source reveals that women with Presidential nominations are more likely to retain past minimum service requirement while those with a Qualified Alternate nomination are less likely to retain to the O-4 promotion board. RAB points have no effect on retention, to either minimum service requirement or to O-4, nor does participation in varsity athletics. Women with prior enlisted service are significantly more likely to retain, both past minimum service requirement and to O-4. Minorities are more likely to retain past minimum service requirement. Finally, designator choice has a significant impact on the probability of retention for women with Surface Warfare Officers and Supply officers being the least likely to retain.

## **V. LATERAL TRANSFER SYSTEM**

### **A. INTRODUCTION**

As discussed in Chapter II, female officers have significantly lower retention rates than their male peers, particularly in the Surface Warfare community. A recent study of lateral transfers from the SWO community to the Restricted Line (RL) and staff corps confirmed this trend. The authors stated that “because of the recent increase in the female share of SWO accessions, there is a risk associated with assuming that female retention...will equal the rates of male SWOs in the future.” A sensitivity analysis performed in the study “assumes that overall SWO retention decreases because more women are becoming SWOs” (Monroe IV and Cymrot, 2004, p.26).

Koopman, Thomas, Parcell, and MacIlvaine (2000) found that, by the 36 month point in service, more women than men lateral transfer out of the Surface Warfare and Aviation communities. If women do have a higher lateral transfer rate than men, this may partially explain the low female retention rates currently plaguing the Surface Warfare community. The purpose of this chapter is to determine why officers lateral transfer and to determine if women have a higher likelihood of transferring out of the URL than men. The regression analyses will determine the characteristics of officers most likely to transfer out of the URL; relevant characteristics include original URL community, commissioning source, and demographics. Separate analyses will be conducted for officers who transfer from one URL community to another and those who transfer from the URL to an RL community such as Intelligence, Cryptology, Public Affairs, Engineering Duty, and Meteorology.

### **B. BACKGROUND**

The lateral transfer system within the U.S. Navy facilitates the efficient use of personnel. Officers who are not well matched in their original (ensign) community have the opportunity to transfer into another community that offers a better fit. As indicated by Moore and Reese (1997), “to some extent, redesignation is both inevitable and desirable, and high rates of early-career redesignation do not necessarily imply that something is amiss” (p.5). By facilitating individual-job fit, the option to lateral transfer

may increase overall retention within the Navy and improve job satisfaction and performance. Thus the role of the lateral transfer system is to optimally match officers to communities, maximizing the return on investment for each officer.

Lateral transfers within the officer corps generally follow one of two paths. First, an officer within the primary URL communities of Surface Warfare (SWO), Aviation (Pilot and NFO) and Submarine Warfare may transfer to another URL community. This typically occurs due to training attrition. The officer fails to achieve his warfare qualification in his original community and transfers to another community. The URL-to-URL flow of officers is generally from aviation into surface warfare, as aviation has a lengthy qualification processes with a high likelihood of training attrition. The submarine warfare community also has a competitive and challenging training process that results in a significant attrition rate. However, due to the relatively small size of the submarine community, only one-eighth of all lateral transfers come from this community (Monroe IV and Cymrot, 2004).

The second path of lateral transfer is from the URL to an RL community. This “second type does not result from training attrition...it tends to be driven by the officer’s professional interests, perceived chances of promotion to senior grades, and eventual civilian career plans” (Moore and Reese, 1997, p.1). The Navy benefits from the URL-to-RL transfers by staffing support communities with officers who have proven warfighting experience. Over the past 15 years, approximately 350 officers have transferred from the URL into the RL or staff communities annually. Even though total officer strength has fallen by 35 percent over this period, the absolute number of lateral transfers to the RL has remained relatively constant (Monroe IV and Cymrot, 2004).

As indicated above, URL-to-URL transfers typically occur into the SWO community. Moore and Reese (1997) found that approximately 25 percent of original URL accessions have historically failed to finish training in their first community. Of these, about 58 percent lateral transferred to another community. The surface community is the most frequent destination of these attrited officers. However, there has been a small downward trend in training attrition in the Pilot and Submarine communities,

slowing the influx of lateral transfers into the SWO community. On average, those officers who attrite from training and lateral transfer do so at about two years of service.

## **C. METHODOLOGY**

### **1. Model Specification**

Moore and Reese (1997) developed a model of training attrition, examining factors that predict training attrition and measuring the frequency with which attrition occurred. The factors used to predict attrition included race, gender, original community, accession source, and dependency status. By documenting training attrition patterns, the authors were better able to understand the supply of training attrites who enter the Navy's lateral transfer system. The factors that predict training attrition are thus similar to the factors that predict lateral transfer, particularly from the URL-to-URL. For this analysis, gender, race, original URL community, and commissioning source were used to predict the probability of lateral transfer out of the URL into either another URL community or into an RL community. Additional variables included URL warfare qualification (the dependent variable in the Moore and Reese study) and whether or not the officer had prior enlisted service. Dependency status was not included in this study due to limited data.

Due to the binary nature of the dependent variable, logistic regression employing maximum-likelihood techniques was used to predict the probability of lateral transfer.

### **2. Hypothesized Relationships**

Hypothesized relationships for the factors affecting the decision to lateral transfer are presented in Table 9.

**Table 9. Hypothesized Relationships of Independent Variables on Decision to Lateral Transfer**

Variable	URL-to-URL	URL-to-RL
Female	?	?
NROTC contract	+	?
NROTC scholarship	+	?
OCS	+	?
NFO	+	-
Sub	+	-
Pilot	+	-
Warfare qualified	-	+
Prior service	?	?
Hispanic	+	?
Black	+	?
Other race	+	?
* Hypothesized relationships are based on comparison with base case of USNA, SWO, White		

Due to the paucity of research concerning lateral transfers, two-tailed tests will be conducted for the majority of the variables. However, Koopman, Thomas, Parcell, and MacIlvaine (2000) did find that, by the 36 month point in service, more women than men lateral transfer out of the Surface Warfare and Aviation communities. The focus of this analysis will be to confirm whether women do have a greater likelihood than men to lateral transfer out of the URL. In addition, previous research (Moore and Reese, 1997; Monroe IV and Cymrot, 2004) indicates that SWOs, the base case URL community in this analysis, are least likely to transfer to another URL community, but most likely to transfer to the RL. The results of the Moore and Reese study on likelihood to attrite from training also provide hypothesized relationships for URL-to-URL transfers. Moore and Reese found that USNA graduates are least likely to attrite from training, thus these officers would be least likely to transfer to another URL community. Similarly, white officers are less likely to attrite than minority officers, lending to a positive relationship between the minority race variables and probability of transferring to a second URL community.

## **D. DATA, SAMPLE, AND PRELIMINARY DATA ANALYSIS**

### **1. Data and Sample**

Data were obtained from the Naval Officer Promotion History File, as provided by Professor William R. Bowman at the U.S. Naval Academy. The file consisted of 19,102 officers commissioned in year groups 1986 through 1991. The Naval Officer Promotion History File tracks officers' history up to the O-4 promotion board. This data was merged with O-3 and O-4 promotion board results and loss data files. The loss data files were created by the Defense Manpower Data Center.

For this analysis, only those officers commissioned into the URL communities of SWO, SUB, NFO, and Pilot were included. After eliminating officers commissioned into Special Warfare, Special Operations, restricted line communities, the staff corps, and those observations with missing data, the final data set contained 14,946 observations. 130 officers in the sample had lateral transferred twice. For these observations, the first lateral transfer was treated as the only transfer so the officers would not be counted twice in the analyses.

Two separate samples were used for this study. To determine characteristics of officers who transferred from one URL community to another URL community, the sample included those officers who remained in their ensign URL community and those who transferred within the URL. The URL-to-URL sample contained 13,516 observations. To determine characteristics of officers who transferred from the URL to the RL, the sample included those officers who remained in their original URL community and those who transferred to the RL. The URL-to-RL sample contained 13,765 observations.

### **2. Variable Descriptions**

The dependent variable for both regression equations is a binary variable that indicates whether the officer lateral transferred out of his/her ensign community.  $TRF\_DIR = 1$  for those officers who did transfer and  $TRF\_DIR = 0$  for those who did not lateral transfer.

The independent variables for both regressions represent demographics (gender, race, prior-enlisted service), commissioning source, ensign URL community, and URL

warfare qualification. Each independent variable is binary. The base case for the regressions was male, white, USNA graduate, Surface Warfare Officer. Table 10 describes the dependent and independent variables used in both the URL-to-URL and URL-to-RL analyses.

**Table 10. Description of Dependent and Independent Variable for Lateral Transfer Analysis**

Variable Description	Variable Name	Range
<u>Dependent Variable</u>		
Lateral transfer	Trf_dir	= 1 if lateral transfer out of ensign URL community = 0 if remained in ensign URL community
<u>Independent Variables</u>		
<u>Demographics</u>		
Gender	Female	= 1 if female, = 0 if male
Race: White		BASE CASE
Race: Black	Aframer	= 1 if black, = 0 otherwise
Race: Hispanic	Hisp	= 1 if Hispanic, = 0 otherwise
Race: Other	Other	= 1 if Native American or Asian-Pacific, = 0 otherwise
Prior Service	Priorser	= 1 if prior enlisted, = 0 if no prior enlisted service
<u>Commissioning Source</u>		
Naval Academy		BASE CASE
NROTC scholarship	Nrotc_s	= 1 if NROTC scholarship, = 0 otherwise
NROTC contract	Nrotc_c	= 1 if NROTC contract, = 0 otherwise
Officer Candidate School	Ocs	= 1 if OCS, = 0 otherwise
<u>Ensign URL Community</u>		
Surface warfare		BASE CASE
Pilot	Plt	= 1 if Pilot, = 0 otherwise
NFO	Nfo	= 1 if NFO, = 0 otherwise
Submarine warfare	Sub	= 1 if Sub, = 0 otherwise
<u>URL Warfare Qualification</u>		
Warfare Qualification	Urlqualt	= 1 if URL warfare qualified by O-3 board, = 0 otherwise

### 3. Descriptive Statistics

Table 11 describes the full sample of URL officers by lateral transfer decision.

**Table 11. Characteristics of URL Officers by Lateral Transfer Decision**

<b>Variable</b>	<b>Value</b>	<b>Full Sample</b>	<b>Remained in URL</b>	<b>Transferred URL to URL</b>	<b>Transferred URL to RL</b>
Female	%	2.7	2.46	0.68	6.43
USNA	%	25.18	25.29	23.54	25.59
NROTC contract	%	3.97	4.01	3.9	3.71
NROTC scholarship	%	37.3	39	48.18	42.31
OCS	%	30.8	31.69	24.39	28.39
SWO	%	35.27	36.76	18.63	36.15
Sub	%	16.26	15.53	28.03	12.8
NFO	%	15.84	14.89	20.66	20
Pilot	%	32.63	32.82	32.68	31.05
White	%	91.19	91.64	92.21	86.5
Black	%	4.32	4.09	3.56	6.92
Hispanic	%	2.36	2.22	2.03	3.78
Other race	%	2.13	2.04	2.2	2.9
Prior service	%	5.21	4.92	4.06	8.6
Warfare Qualified	%	69.43	74.1	48.35	46.57
Number of Observations		14,946	12,335	1181	1430
Percentage of Total Sample		100	82.53	7.9	9.57

Females were most likely to transfer to the RL and least likely to transfer from one URL community to another. The greater likelihood of women to transfer into the RL is consistent with the findings of Koopman, Thomas, Parcell, and MaccIlvaine (2000). Black, Hispanic, and other minority officers are more likely than white officers to lateral transfer to the RL.

Officers accessed through the NROTC scholarship program are most likely to lateral transfer, either to a second URL community or to the RL. OCS and USNA officers appear least likely to lateral transfer, although it is difficult to judge the magnitude of these differences based on descriptive statistics alone. Nevertheless, the statistics appear to support Moore and Reese's (1997) findings that USNA graduates are least likely to attrite from training and thus lateral transfer to another URL community.

The rate of warfare qualification is significantly lower for lateral transfers (both URL-to-URL and URL-to-RL) than for those who stayed in their original URL community. Monroe IV and Cymrot (2004) found that the percentage of laterals with warfare qualifications has remained relatively stable over time at approximately 60



percent. The samples used for this study have slightly lower warfare qualification rates, 48.35 percent for URL-to-URL and 46.57 for URL-to-RL, but these rates are within range of the 1986-2002 rates reported by Monroe IV and Cymrot. The higher rate of warfare qualification for URL-to-URL transfers than URL-to-RL transfers is contrary to expectations. Transfers within the URL community are typically due to training attrition which should be reflected by lower rates of warfare qualification. However, the warfare qualification variable indicates warfare qualification before the O-3 promotion board. The data may reflect training attrites from the aviation and submarine communities who achieved their SWO qualification within the allotted time period.

Table 12 describes the sample of URL officers by their original community.

**Table 12. Characteristics of URL Officers by Ensign Community**

Variable	Value	SWO	Pilot	NFO	Sub
Remained in ensign community	%	86.02	82.98	77.61	78.85
Transferred to other URL community	%	4.17	7.92	10.31	13.62
Transferred to RL	%	9.81	9.1	12.08	7.53
Female	%	2.98	3.69	2.83	2.83
USNA	%	27.45	23.8	19.77	19.77
NROTC contract	%	5.56	4.24	3.8	3.8
NROTC scholarship	%	50.28	35.08	35.36	35.36
OCS	%	16.71	36.88	41.06	41.06
White	%	86.51	94.4	91.68	91.68
Black	%	7.32	2.71	3.89	3.89
Hispanic	%	3.17	1.72	2.49	2.49
Other race	%	3	1.17	2.49	1.94
Prior service	%	6.6	3.92	1.94	7.35
Warfare qualified	%	64.66	82.19	36.13	88.17
Number of Observations		5271	4878	2367	2430
Percentage of Total Sample		35.27	32.63	15.84	16.26

Pilots, NFOs and submarine officers are more likely to transfer to another URL community than SWOs. This is consistent with previous research (Moore and Reese, 1997; Monroe IV and Cymrot, 2004) and the practice of URL-to-URL transfers being due to training attrition. NFOs have the highest percentage of transfers to the RL (12.08 percent), followed by SWOs (9.81 percent) and pilots (9.1 percent). This is contrary to the hypothesis that SWOs have the highest rate of transfer to the RL, but may reflect the

low rate of warfare qualification of NFOs (36.13 percent) compared to SWOs (64.66 percent). It is likely that the NFO laterals were not warfare qualified upon transfer to the RL, while the majority of SWO laterals had already achieved warfare qualification. Monroe & Cymrot (2004) found that the majority of warfare qualified laterals are from the surface community.

Table 13 presents the characteristics of URL officers, including the propensity for lateral transfer, based on gender.

**Table 13. Characteristics of URL Officers by Gender**

<b>Variable</b>	<b>Value</b>	<b>Male</b>	<b>Female</b>
Remained in ensign community	%	82.73	75.25
Transferred to other URL community	%	8.06	1.98
Transferred to RL	%	9.21	22.78
SWO	%	35.17	38.86
Pilot	%	32.31	44.55
NFO	%	15.82	16.58
Sub	%	16.71	0
USNA	%	24.95	33.66
NROTC contract	%	3.95	4.7
NROTC scholarship	%	40.29	31.19
OCS	%	30.81	30.45
White	%	91.18	91.58
Black	%	4.33	4.21
Hispanic	%	2.32	3.47
Other race	%	2.17	0.74
Prior service	%	5.24	3.96
Warfare qualified	%	69.34	72.52
Number of Observations		14,542	404
Percentage of Total Sample		97.3	2.7

Males are more likely than females to transfer within the URL, while females are more likely than males to transfer to the RL. Females have a warfare qualification rate (72.52 percent) slightly higher than males (69.34 percent) which is consistent with an increased propensity for URL-to-RL transfer and a reduced propensity for URL-to-URL transfer. The finding that women are more likely to transfer into the RL is consistent with findings of Koopman, Thomas, Parcell, and MacIlvaine (2000).

## E. RESULTS

The estimation results for the URL-to-URL and URL-to-RL models are presented in Table 14.

**Table 14. Regression Estimates and Partial Effects for URL-to-URL and UR-to-RL Transfers**

	URL to URL			URL to RL	
Variable	Parameter Estimate	Partial Effect		Parameter Estimate	Partial Effect
Intercept	-2.5428			-1.6105	
Female	-1.2073***	-0.023		0.9674***	0.3446
NROTC contract	0.3326*	0.0988		-0.0317***	-0.1622
NROTC scholarship	0.4386***	0.1087		0.1609**	0.1901
OCS	-0.2187**	-0.0594		-0.0386	-0.1612
NFO	1.7078***	0.3026		0.8856***	0.3263
Sub	1.0895***	0.1895		-0.4417***	-0.1138
Pilot	1.2040***	0.2077		0.3740***	0.2251
Warfare qualification	-1.4219***	-0.0186		-1.5096***	-0.0423
Prior service	-0.0557	-0.0692		0.5131***	0.2502
Hispanic	0.0080	0.0735		0.3811**	0.2263
Black	0.1116	0.0808		0.4216***	0.2335
Other race	0.1119	0.0808		0.2299	0.2009
Number of observations	13,516			13,765	
R-squared	0.1135			0.1038	
Likelihood Ratio: test for fit	p<.0001			p<.0001	
% Correct (classification table)	64.1%			64.8%	
* Significant at .1, ** Significant at .05, *** Significant at .01 Note: Partial effects compared to base case of male, USNA, SWO, white					

The partial effects indicate the probability of lateral transfer when compared to the base case: male, USNA graduate, SWO, and white. For example, the probability of a female transferring URL-to-URL is 0.023 less than that of a male and an NROTC scholarship graduate has a 0.19 higher probability of transferring URL-to-RL than a USNA graduate.

Both models demonstrate acceptable goodness-of-fit. The low R-squared for both models is typical for logistic regression conducted on a large sample. The classification tables for both models indicated that the models correctly classified approximately 64

percent of the observations. All variables are statistically significant, except for the race variables and the prior service variable in the URL-to-URL model.

Four interaction variables were tested for both models. The variables interacted gender (female) with SWO, pilot, USNA, and NROTC scholarship. None of the variables were statistically significant and were thus not included in the final models.

A Log-Likelihood Ratio Test was conducted to determine if separate regressions equations should be estimated for men and women who transfer URL-to-RL. The results of the test ( $p=0.9294$ ) revealed that separate equations for each gender were unnecessary.

### **1. Discussion of URL-to-URL Results**

Males have a higher likelihood than females to laterally transfer URL-to-URL. Race is not statistically significant. The race variables are not individually significant and a nested models Chi-squared test revealed that the race variables are not jointly significant ( $p=0.8816$ ).

The probability of lateral transfer based on commissioning sources is highest for NROTC scholarship graduates, followed by NROTC contract, USNA, and OCS. These results are consistent with the hypothesized relationships, except for the negative sign on the OCS variable. Pilots, NFOs, and submarine warfare officers are each more likely to transfer to another URL community than SWOs. NFOs have the highest probability of lateral transfer, followed by pilots and submariners. These results are also consistent with the hypothesized relationships.

The warfare qualification variable is negative, indicating that officers with a warfare qualification are less likely to transfer to another URL community. Once again, this is consistent with previous research and the hypothesized relationship. The prior service variable is not statistically significant.

### **2. Discussion of URL-to-RL Results**

Females are more likely than males to transfer URL-to-RL. The variable is highly significant and the partial effect reveals that females have a probability of lateral transfer that is 0.34 higher than males. This result is consistent with the previous findings of Koopman, Thomas, Parcell, and MacIlvaine (2000) who found women more likely than men to transfer out of the Surface Warfare community by the 36 month point of service.

The high probability of female transfer out of the URL may thus partially help explain the low female retention rate being currently experienced by the Surface Warfare community.

Of the commissioning source variables, only NROTC scholarship is significant; however, a nested model Chi-squared test determined the three variables to be jointly significant ( $p=0.0225$ ). NROTC scholarship graduates have the highest probability of URL-to-RL transfer, followed by USNA, OCS, and NROTC contract. In 1995, a policy change required all NROTC graduates to be commissioned into the URL. Thus, the rate of URL-to-RL transfers among NROTC graduates may have increased even more since 1991, the last year group used for this analysis.

NFOs have the highest probability of URL-to-RL transfer, followed by pilots, SWOs, and submarine officers. These results are not consistent with the hypothesized relationships and past research which indicated that the majority of URL-to-RL transfers come from the Surface Warfare community. These results are also inconsistent with the findings of Moore & Reese (1997) that pilot and NFO training attrition was decreasing steadily during the late 1980s. However, changes in the aviation community and the overall downsizing of the Navy may have allowed more warfare qualified aviators to transfer to the RL during this time period.

The negative sign of the warfare qualification variable indicates that warfare qualified officers are less likely to transfer URL-to-RL. This is also contradictory to the hypothesized relationship and the general pattern of warfare qualified officers transferring into the RL and staff corps.

The prior service variable is positive and significant, revealing that officers with prior enlisted experience have a 0.25 higher probability of transferring into the RL than those without prior-enlisted service. This large partial effect may be the result of prior-enlisted officers being more aware of opportunities within the Navy and thus more likely to take advantage of these career-enhancing opportunities.

The Hispanic and Black race variables are individually significant and the three race variables are jointly significant ( $p=0.0005$ ). All minority officers are more likely than white officers to transfer URL-to-RL.

### 3. Prediction of Lateral Transfer Rates

Predicted lateral transfer rates for various sub-groupings of URL officers are presented in Table 15.

**Table 15. Lateral Transfer Rates Predicted by Logit Equations: The Effects of Ensign Community, Commissioning Source, and Gender**

<b>Female</b>	<b>URL to URL</b>	<b>URL to RL</b>
SWO, USNA	0.006	0.104
SWO, NROTC scholarship	0.009	0.120
SWO, OCS	0.005	0.101
Pilot, USNA	0.019	0.144
Pilot, NROTC scholarship	0.028	0.166
Pilot, OCS	0.015	0.140
NFO, USNA	0.030	0.220
NFO, NROTC scholarship	0.046	0.249
NFO, OCS	0.025	0.213
<b>Male</b>		
SWO, USNA	0.019	0.042
SWO, NROTC scholarship	0.029	0.049
SWO, OCS	0.015	0.041
Pilot, USNA	0.059	0.060
Pilot, NROTC scholarship	0.089	0.070
Pilot, OCS	0.048	0.058
NFO, USNA	0.095	0.097
NFO, NROTC scholarship	0.140	0.112
NFO, OCS	0.078	0.093
Sub, USNA	0.053	0.028
Sub, NROTC scholarship	0.080	0.032
Sub, OCS	0.043	0.027
* All probabilities calculated for white, warfare qualified, non-prior service * Logits converted to probabilities: Prob = 1/(1+exp(-logit))		

The predicted lateral transfer rates are consistent with the estimation results and partial effects discussed above. All probabilities are calculated for “average officers” who are white, warfare qualified, and do not have prior-enlisted service. NROTC scholarship graduates have the highest predicted rates of lateral transfer in each category (gender and original community). Overall, males have higher probabilities of transferring URL-to-URL and females of transferring URL-to-RL. The highest probability of transfer is female NFOs transferring to the RL, followed by female pilots,

and female SWOs. The lowest probabilities of transfer are for female SWOs transferring within the URL; this is closely followed by male SWOs transferring within the URL.

## **F. SUMMARY**

This study sought to determine why officers lateral transfer out of their original URL community and whether females are more likely to lateral transfer than males. Although not all results were consistent with previous research and hypothesized relationships, the analysis revealed that females have a greater likelihood of URL-to-RL transfer than males. This higher rate of lateral transfer out of URL communities may partially explain the low female retention rates being experienced by the Surface Warfare community.

The analysis also showed that males are more likely to transfer URL-to-URL. These transfers have historically been due to training attrition from the aviation and submarine communities. NROTC scholarship graduates are most likely to lateral transfer, both within the URL and into the RL, when compared to the other commissioning sources. Minority officers and those with prior-enlisted service are more likely to transfer URL-to-RL but these variables are not significant for URL-to-URL transfers. Finally, SWOs are least likely to transfer URL-to-URL and NFOs are most likely to transfer URL-to-RL. This last result is inconsistent with past research, which found SWOs should be more likely to transfer URL-to-RL.

## **VI. CONCLUSIONS AND RECOMMENDATIONS**

### **A. CONCLUSIONS**

The Navy has been struggling with poor retention among female junior officers, particularly those in Unrestricted Line communities. A review of the qualitative research concerning female officer retention reveals that women are leaving the Navy due to dissatisfaction with opportunities and leadership, difficulty balancing work and personal commitments, and competing family obligations. This thesis seeks to determine whether current Naval Academy selection metrics are effective in selecting women with a propensity for extended Naval service and how the Navy's lateral transfer system affects the retention of female officers in Unrestricted Line communities.

#### **1. Whole Person Multiple**

The Whole Person Multiple metric used by the Naval Academy Admissions Board is not effective in selecting women with a propensity for either graduation or fleet retention. Very few of the WPM elements are significant and positive in predicting graduation or retention. Math SAT scores are a valid predictor of both graduation and retention. However, contrary to previous research, RAB points can actually have a negative effect on graduation, indicating that the Admissions Board is awarding points to women who are less likely to graduate. Finally, only the math SAT score, teacher recommendation score, and extracurricular activities score are positive predictors of retention to minimum service requirement. None of the WPM elements are valid predictors of retention to the O-4 board.

Other selection variables include prior enlisted service and athletic status. Women with prior enlisted service are more likely to retain at all points—graduation, minimum service requirement, and O-4 promotion board. Supporting the results of previous research, participation in a varsity sport at the Naval Academy, whether as a recruited and non-recruited athlete, has a significant impact on the likelihood of graduation. However, contrary to findings based on a mixed gender sample, varsity athletic status has no impact on the decision to remain in the Navy past minimum service requirement.



## **2. Nomination Process**

The Naval Academy's nomination process is also not effective in predicting women's propensity for graduation or retention. Previous research conducted on a mixed gender sample concluded that candidates with other-than-Congressional nominations are more likely to graduate (Bowman and Mehay, 2004). However, in this study of females only, nomination source has no impact on the graduation decision. The retention analyses indicate that women with Presidential nominations are more likely to retain past minimum service requirement, while women with Qualified Alternate nominations are less likely to retain to the O-4 board.

## **3. Lateral Transfer System**

The analysis of characteristics of officers in the Navy's lateral transfer system reveals that women are 34 percentage points more likely than men to lateral transfer to the Restricted Line from their original Unrestricted Line community. This result is consistent with previous research and helps explain the overall low retention rates for female URL officers. Unrestricted Line communities, particularly Surface Warfare, are losing their female junior officers to the Restricted Line, as well as to the civilian sector.

# **B. RECOMMENDATIONS**

## **1. Changes to the Naval Academy Selection Metric**

Due to the lack of significance of most WPM elements in predicting female graduation and retention, it is recommended that the Naval Academy Admissions Board may want to consider finding new factors, or utilizing differing weights on current factors, that will better predict the success of female candidates at the Naval Academy and later as junior officers in the fleet. A possible change is to maintain the current weight of the math SAT scores but increase the weights of the teacher recommendation and extracurricular activities scores. This recommendation is consistent with the results of this thesis and previous research which found that non-academics predictors are best for predicting non-academic success during and after college (Burton and Ramist, 2001; Neumann and Abraham, 1989).

In 2003, the Supreme Court rule that college admissions committees are no longer permitted to award points for minority or demographic groups simply due to membership

in that group. However, colleges are permitted to award points for special achievement of the minority or demographic group that may not otherwise be reflected in standard admissions selection criteria (U.S. Supreme Court, 2003). The re-weighting or alteration of the WPM metric for women at the Naval Academy should be undertaken so as to comply with the Supreme Court ruling.

## **2. Changes to the Nomination Process**

Reasons why the Admissions Board awards specific nominations are not known. Women with Presidential and Qualified Alternate nominations appear quite similar, on average. Yet, those with Presidential nominations are more likely to retain past minimum service requirement while those with Qualified Alternate nominations are less likely to retain to the O-4 board. Thus the Admissions Board should emphasize those qualities and attributes that result in a Presidential nomination and de-emphasize those attributes that lead to a Qualified Alternate nomination.

## **3. Role of the Lateral Transfer System**

Research consistently indicates that women are more likely than their male peers to lateral transfer from the URL into the RL. As the number of female accessions into Unrestricted Line communities, particularly Surface Warfare, continues to grow, the Navy must determine to what extent the Surface Warfare community will bear the burden of training junior officers who plan to leave the community at the earliest opportunity. Further research should focus on the cost-effectiveness of the lateral transfer system, with a particular emphasis on how gender affects the system.

## **4. Further Research**

Further research should be undertaken to expand our understanding of the retention of female Unrestricted Line officers. This thesis should be repeated with larger samples and more recent data. Larger samples should include male observations in order to compare retention predictors for men and women. This research should also be repeated for NROTC and OCS graduates to determine if the results are generalizable for officers from all commissioning sources. It is hypothesized that the results should be generalizable for NROTC graduates due to the similarity between the Naval Academy and NROTC 4-year scholarship selection processes. Nevertheless, additional research is recommended to verify this hypothesis.

Using more recent data is important because each sample used in this thesis ended with the 1991 officer cohort. Two significant policy changes have occurred since 1991. First, numerous combat exclusions for women were repealed in the early 1990s. In 1991, Congress voted to allow women to fly combat missions. This amendment was fully implemented in 1993, as well as the assignment of women to combatant ships. The opening of opportunities for women within the URL since 1991, combined with the growing number of female officer accessions, may result in significantly altered estimations and predictions for similar studies with more recent data. Second, NROTC and USNA graduates are now required to be commissioned into the URL. This policy was implemented in 1995 and may have significantly impacted the rate of URL-to-RL transfers, particularly among NROTC scholarship graduates and women who graduate from the Naval Academy.

## **5. Other Policy Options**

The Navy should also consider that changing selection metrics may not be the answer for the current female officer retention problems. The majority of women who leave the Naval Academy do so voluntarily. Previous research indicates that women leave the Navy due to Navy “taste factors,” dissatisfaction with leadership, and competing family obligations (Clifton, 2003; Hosek et al., 2001). The 2004 SWO Continuation Poll found that the factors cited by women as reasons for leaving the Navy are different from those of their male peers. Women listed SWO morale, work/personal time balance, and the impact of career on family as primary reasons for leaving the SWO community and the Navy (Newell, Whittam, & Uriell, 2004). Therefore, the Navy should investigate other policy options that are focused on the needs of female officers. These options might include a voluntary Leave of Absence option and Quality of Life programs that are aimed specifically at the needs of women.

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